THE

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THE RATING OF TRAMWAYS.

FOR some time those who are responsible for tramway undertakings have been under the impression that the track through the streets is subject to special treatment at the hands of the rating authorities. It goes without saying that some measure of relief from the full burden of rates would be of enormous advantage to tramway enterprise; and in our view the exemption would also be justifiable. In the first place, the duty of repairing the roadway between and for some distance on either side of the metals, has always been imposed upon the tramway authority. That in itself constitutes a claim for exemption from some part of the district rate. In the second place, the competition of the motor-'bus, which practically pays no rates at all, has rendered it more and more difficult for the electric tram to pay running expenses. As we shall presently see, however, these considerations have but little weight with those who have to administer the law. The measure of relief which the tramway has enjoyed may be stated in two words. In respect of property of certain special classes the general district rate is made, not upon the whole, but upon one-fourth part only of the net annual value. Amongst these classes are (*a*) land used only as a canal or towing path for the same; (*b*) land used only as a railway constructed under the powers of any Act of Parliament for public conveyance.

The contention that tramways, such as we know them ordinarily, are entitled to be treated as railways, was first put forward in the case of Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority (1892) I. Q.B. 357. There the appellants under the powers given them by certain local Acts of Parliament conducted a tramway communicating by points and switches with a railway in their possession, which was worked by them in conjunction with a railway, and which had been constructed under an Act of Parliament. It was held that the land occupied by the tramway was not "used only as a railway" within the meaning of the Act, and that the appellants were not entitled to be rated in respect of it in the proportion of one-fourth part only of its net annual value. Mr. Justice Wills, in giving judgment, said: "The legislature when it passed that Act did not think it necessary to define a tramway, and as definition is always '*periculosæ plenum opus aleæ*,' I shall follow the example of the legislature and not attempt to define either railway or tramway. It appears sufficient to say that no ordinary person has any difficulty in distinguishing between the two. It seems to me, therefore, that the exemption in favour of railways cannot have been intended in the Act of 1875 to cover tramways."

Thus it came about that in 1892, tramways, as ordinarily known, were held to be not exempt. Then the light railway made its appearance, and it has actually been held that,

although a tramway and a light railway may be physically similar in every detail, the light railway is exempt, while the tramway is not! In this connection reference need only be made to the case of Wakefield and District Light Railways Co. *v.* The Wakefield Corporation (1908), A.C. 293. In that case, a company were the owners of a light railway constructed under an order made under the Light Railways Act, 1896. The railway, which physically resembled a tramway, was laid along certain open streets, and the order, while preserving to the public their ordinary right of passage over the highway, provided that the company should have the exclusive use of the railway for carriages with flange wheels. The company having been assessed to the general district rate in respect of their occupation of the railway, it was held upon the construction of Sec. 12 Sub.-Sec. 2 of the Light Railways Act, 1896, that Sec. 211, Sub.-Sec. 1 (*b*), of the Public Health Act, 1875, applied to light railways; that, notwithstanding the user by the public of the surface of the streets in exercise of their right of passage, the company were occupiers of the land used only as a railway constructed under the powers of an Act of Parliament for public conveyance within the meaning of Sec. 211, and were consequently entitled to be assessed to the general district rate in respect of the said railway at one-fourth only of its net annual value.

Founding no doubt very largely upon this decision, it appears that the Metropolitan Electric Tramways Co. preferred an appeal from their rates in the Tottenham district on the ground that they were entitled to exemption both in respect of the tramlines belonging to them, which were part of a light railway, as well as in respect of the tramlines which were really part of a tramway. The facts which have already been reported were these. The company owned, occupied, and worked as one connected system a tramway and a light railway, which were constructed in and along certain public streets and roads in the district of an urban council. The tramway and the light railway were constructed and worked under and subject to the provisions of certain local Acts and Orders; they had a junction with each other, and were worked by electricity on the overhead system. They were identical as to mode of construction and materials used, and the rails of each were laid with their uppermost surface level with the surface of the highway; the same carriages were used upon them, and ran through from the one on to the other, and the electrical energy used for working both the tramway and the light railway was generated at the same power station and thence transmitted over a common system of cables and mains to sub-stations. It was held by the Court of Appeal that the tramway was "land used only as a railway constructed under the powers of an Act of Parliament" within the meaning of Sec. 211, Sub.-Sec. I (*b*), of the Public Health Act, 1875, and that the company were therefore entitled in respect of their tramway to be assessed to the general district rate at one-fourth only of its net annual value. In this case the decision in Swansea Improvements and Tramways Co. *v.* Swansea Urban Sanitary Authority (*supra*) was over-ruled.

It is this decision of the Court of Appeal which has itself been over-ruled by the House of Lords. In the course of his judgment Lord Moulton said:—

> If it were admissible to speculate as to the motives of the Legislature in exempting railways from the full burden of the rates, I should be inclined to adopt the views expressed by Mr. Justice Earle in the case of The South Wales Railway Co. *v.* The Swansea Board of Health. He there says:—"The general scheme of the enactment is that the occupiers of the classes of property most benefited by the expenditure of the district rates shall be liable to be rated at a higher rate, the occupiers of the classes less benefited at the lower rate." This fully accounts for the exemption of railways running on their own lands and partaking of few, if any, of the advantages of municipal expenditure so far as their line is concerned. But tramways are not in the like position. The public streets provide them not only with support for their rails, but also, as it were, with arrival and departure platforms, for they collect and deposit their passengers all along the route which they take. I can think of no class of property within a town which more directly, and to a fuller extent, reaps advantage from municipal expenditure, in the way of construction, maintenance, lighting and sewering of streets (which forms so large an item of municipal expenditure), in addition to its dependence on the general prosperity of the town, which is secured by municipal expenditure on other objects. Tramways seem to me so little *in pari casu* with land solely occupied for railways in the matter of meriting exemption from rates that I have the greatest doubt whether any responsible authority in 1875 would have proposed to exempt tramways from the full burden of rates, or if they had proposed it, the Legislature would have granted it."

He then went on to point out that in point of fact the Light Railways Act had been abused, inasmuch as it had been put in force by astute promoters who saw that an advantage could be gained by putting forward schemes for tramways in the guise of light railways.

The conclusion of the whole matter is that where a tramway runs along the street and joins on to a light railway, the latter undertaking is entitled to exemption, while the former is not! If ever the famous *dictum* of Mr. Bumble anent the law of England were justifiable, this is surely the occasion. In future those who desire to invest in tramways will do well to enquire whether their property is in reality a tramway or a light railway.

COAL, GAS AND ELECTRICITY.

We have it on the authority of Mr. D. A. Thomas, of the Cambrian Coal Combine, that "Old King Coal is a Merry Old Soul," and when we observe the prices at which electricity supply undertakings are entering into contracts nowadays we are inclined to add that he has good reason to be so. Exceptional and continued industrial activity, even in these days of electric driving, means a big demand for fuel, and when owners can fix their own figures, consequent upon everybody wanting more of their commodity, they are naturally in high spirits. Borough and other electrical engineers who have to pay these higher prices will not find any relief by wondering how far minimum wage legislation and how far industrial and naval activity are to blame for their heavier burden. Some of them have turned to their Diesel engines with a sigh of relief as saving them from high coal price troubles in the future, only to be confronted with possibilities in the direction of oil fuel prices and shortage. And so Mr. Thomas continues his merry song foretelling for his majesty a merry life for many years yet to come. "The total quantity of oil in the world to-day available for fuel purposes was less than 2 per cent. of the total production of coal, and how was 2 per cent. going to take the place of 100 per cent.?" But Mr. Thomas is not the only performer in this summer festival, for Sir Corbet Woodall, the chairman of the Gas Light and Coke Co., has been addressing his shareholders. Now he, too, is interested in the price of coal, but he has to *pay*, and we can imagine the heart of the Cambrian owner rejoicing as he learns from Sir Corbet that his coal is costing him more by hundreds of thousands sterling per annum. The Gas Co. has been passing through "times of stress" with "abnormal prices of coal," but the end is not yet, for contracts extending over the next 12 months have been made at prices even materially higher than those paid last year; it is estimated that those contracts will involve an additional expense of about £175,000! And yet Sir Corbet Woodall is a merry old soul too, and the reason of his contentment is not far to seek, for he is able to show an advance of 432,000,000 cb. ft. of gas sold in the past half-year, as compared with the corresponding period of 1912. But instead of calling for his pipe, his glass and his fiddlers three, the Gas Light chairman settles harder to his task, merely telling his shareholders that this circumstance of progressive business may be taken as furnishing gratifying evidence of the "resources available to the company in times of stress." Electrical men who want to know what is the probable course of future coal prices will undoubtedly listen with full respect when so big a coal consumer as Sir Corbet expresses himself on that matter. He says that while it is impossible to forecast the future with any degree of confidence, he will be greatly surprised if the price of coal does not show a material reduction by the time the

present contracts have expired. What are to be the causes working to that end he does not indicate; whether a falling off in trade, or a more settled outlook abroad, or what else, it is useless to surmise. But returning now to that reference to available resources. The Gas Light and Coke Co. continues to add thousands of new gas stoves to its mains every year; this we presume is the principal "available resource," and the company certainly does endeavour to cultivate this field in an enterprising way, as the average consumer will tell us. We hope the day will be hastened when electrical men will cut as easily into the gas cooking load as they have already done into the gas lighting load, when it will be as easy to get the consumer to take the electric as it is to get him to take a gas stove. Education is largely what is required. Gas stoves are giving way in places to electric, but the gas authorities have still a vast number of people to cater for who have neither electric nor gas cooking service in their homes. Presumably these form a large part of the "available resources" mentioned.

One other word from the speech of Sir Corbet Woodall calls for attention from electric supply men. He says that the National Gas Exhibition is receiving active support from the majority of the gas undertakings of the Kingdom, and that it will be opened by the Lord Mayor on October 1st. We will add nothing further at this stage save a hint that October should be a month of greatly increased commercial activity on the part of all electric supply authorities in and around the metropolis. Were the Electric Supply Publicity Committee not listless it might have given an energetic lead. But as matters stand, nobody would dream of looking that way for leadership. Apparently it lies in a comatose condition! We must all help ourselves—unless we are to look to the "Point Fives."

Rubber. In spite of all the attempts made to infuse cheerfulness into the rubber market, the tone remains one of comparative dejection, and in all probability the ultimate course of prices is to a still lower level. There is no doubt that the Near East can produce rubber in enormous quantities at, say, 1s. 3d. a lb., and the tonnage produceable at this figure or thereabouts, is bound to increase as new plantations get into bearing, and as methods of production are improved. All attempts artificially to hold up prices are bound to fail in the long run. It is no use for syndicates or groups to put their heads together to hold back material, or to endeavour in other ways to manipulate the market, for all such schemes will inevitably recoil on the heads of their promoters. No doubt shareholders would welcome any development tending to arrest the dry-rot in the prices of rubber and of the shares of producing companies in the Near East and elsewhere, but no development arising out of the manipulation of supplies can be attended with permanent good. It is futile to talk of ultra-pessimism on the part of the investing public. The investing public have been hard hit, and have in too many cases seen their capital dwindle down to a fraction of the original investment, while the utmost that can be reasonably hoped is that the increased output of the plantations may go some way towards making up the deficit in the price per lb. Somewhere round current prices the market is finding a temporary resting place, but it must not be anticipated that even these figures can last, for the tendency of supplies is to increase, and the manipulation of the market for fine hard Para is a weak spot. Brazilian Para rubber stands at an altogether abnormal level compared with the plantation product, and it is only a matter of time for a readjustment to take place; and this is far more likely to be effected by a fall in Para than by an appreciation in the price of plantation. The proposal to form a Rubber Companies' Shareholders' Association may be a good one, but it can hardly succeed in evolving a formula for freeing the rubber market from the logical effects upon prices of growing production. As for the rumoured formation of an "International Rubber Syndicate" under the auspices of the Belgian Government, with a capital of 50 million francs, for the purpose of restricting output, in conjunction with the Governments of Holland and Brazil, the scheme can hardly be put forward seriously. No doubt if it were put into operation it would cause a temporary rise in the price of rubber, but the trouble would be to make it effective. It would, however, be a capital thing for the plantations in the Near East, who could increase their output then without any fears as to the consequences. The Belgian Government is, of course, concerned mainly, because of the effect which the fall in the price of rubber is having upon the prosperity of the Congo Colony, and it would, no doubt, be supported more or less whole-heartedly in any possible scheme by the Antwerp rubber dealers, a pretty influential body.

The world's consumption of rubber in 1912 was about 111,600 tons, of which the Middle East contributed some 28,600 tons, while this year it is computed that the consumption will amount to approximately 120,000 tons, of which amount the Middle East is expected to contribute a matter of 45,000 tons. This implies an increase in the output of the plantations in the Middle East of 16,500 tons compared with last year, but there is an offset against this, for the production of wild rubber is being materially reduced, while consumption is decidedly on the increase. Taking the two factors together, the increase in production may be practically counterbalanced by the anticipated reduction of 7,500 tons of wild rubber and the expected increase of 9,000 tons in consumption. There is not the smallest doubt that the collection of wild rubber has become a losing industry at current prices, and the complaints of the Congo traders referred to above reflect the degree to which they have been hit. Further than this, the Mexican revolutionary disturbances have entirely dislocated the guayule industry, and the cessation of production from this branch of the wild rubber trade only serves to accentuate the falling off in supplies of material of this character.

Copper. Copper has had a most interesting market lately, and one which has shocked with surprise the many pessimists who have been prophesying all sorts of calamities and preaching prices down to an unheard-of figure. The fact is that a wave of pessimism has lately passed over all the markets, and while this was sweeping over people's heads they had no time to think of the blue sky above. Now that the wave has ebbed, and the sun is found to be still shining, there has been a gasp of relief and a much more happy frame of mind has developed. So far from the world being threatened with a deluge of copper, as was being foretold a few months ago, the shortage increases in intensity from month to month, owing to one reason or another, but undoubtedly one of the most powerful has been the enormous volume of consumption. On top of this, however, there have been other factors at work, and the most potent recently has been the strike at the Nichols refinery in America, which caused a reduction of 8,000 tons in the United States refinery production last month. Now further labour troubles have developed, this time in the Lake Superior region, which produces about 100,000 tons of copper a year. The trouble seems to be of a radical nature, involving the recognition of the men's union, which has been persistently refused by the mine-owners, and the result is that production has ceased over the whole district and there is reason to fear that water is getting into the mines. If this be so as the consequence of pumping operations having been stopped at certain mines, the outlook is grave in the extreme. In any event the world cannot well do without the 100,000 tons a year which the Lake turns out, and even the temporary shut-off of 8,000 tons a month cannot be regarded with other than the gravest anxiety. The influence which the strike has had upon the market is well shown by the considerable advance in prices sustained lately. There has been a very large run of demand on both sides of the Atlantic, and producers have sold heavily and are now quite well situated for the next couple of months or so. Much depends upon the news from the Lake Superior district, and any appreciable amelioration of the labour condition there would probably bring about a sharp temporary reaction in prices.

D

PIECEWORK AND BONUS SYSTEMS OF WAGES PAYMENT.

By "ZAHLER."

The introduction of any system of piecework or bonus system of payment into a works can be looked at from two points of view, as follows :—

1. As a means of ensuring that for every pound paid in wages, a pound's worth of work is done.

2. As a means of utilising the self-interest of the worker to secure his co-operation in increasing output, and decreasing costs.

As regards the former of these, it may be stated that with modern conditions of factory organisation, the underlying idea is a fallacy. The only method of preventing wages being paid for which no useful work is performed, is personal good management. Good management will result in absence of such waste, no matter what the system of payment may be. Thus, there are large concerns running successfully in which all the workmen are paid simply on a time basis.

An example of this is mentioned in the *American Machinist* of May 31st, 1913, page 761, where it is stated that the 15,000 operatives of the Ford Motor Co. are all paid by the day. Similarly, numbers of successful concerns may be enumerated working on any of the many different methods which have been introduced during recent years.

Good Management.—It might be remarked here that the question of good management above referred to is practically wholly one of personnel. No greater mistake can be made than to imagine that any system can take the place of an intelligent and zealous staff. If the officials be thoroughly well chosen and organised, with mutual confidence between themselves, and a graduated responsibility and power from the highest to the lowest, a good result will be obtained with almost any system. On the other hand, if the staff be unsatisfactory, then the best system in the world will not be a success.

It follows from this, that the second point of view given above is the one from which this subject should be studied, the object aimed at being to transform a reasonably good state of affairs into a still better one ; in other words, to enable the business to develop and improve, and, in addition, to relieve the staff of a good many routine matters, so that they can give their attention to the new developments which are continually necessary.

Pure Piecework.—Before going any further, it is necessary to mention one class of business in which the piecework system pure and simple suffices for the whole of the management, as far as the workpeople only are concerned. This is where the worker is paid so much each, or per dozen, or per gross for his work, be it little or much, independently of any minimum amount of wages per day or week whatsoever. This system, of course, obtains in many parts of the country in many manufacturing trades, as it did in the coal mining industry before the passing of the recent Coal Mines (Minimum Wage) Act. In the engineering and allied trades, however, it only applies in the simpler and undeveloped branches. Especially it applies in what may be described as the "single piece" industries—that is, when the product is finished in one operation by a single workman.

Directly one gets to the highly specialised trades in which the final product is the result of a great many operations, then the pure piecework system cannot be used. We may take it, moreover, that the whole tendency nowadays is for the workman to demand a guaranteed minimum wage, and it may be stated that the great majority of manufacturing engineering works in this country now do this. It is, however, when a system of bonus, or piecework, is superimposed upon a guaranteed minimum wage based upon time rates that certain difficulties crop up of which some are dealt with in the remainder of this article.

Balance and Debt System.—In this system the workman is engaged at a certain weekly rate which amount (*pro rata* to the time spent in the works) the workman receives whether the amount earned, reckoned on the piecework basis, amounts to his time rate or not. That is to say, all work given out is priced at so much per article. At the end of the week the total earned is added up ; if it comes above the man's time rate he receives the excess as a "balance." If, on the other hand, it comes below the time rate, the man nevertheless receives the time rate, the deficit being booked against him as a "debt." This debt must be paid off by the workman out of any subsequent "balance" before he receives payment of any balance he may earn in the future.

"Debts" Not Legally Recoverable.—It may be stated that, generally speaking, the debts spoken of in the preceding paragraph are not legally recoverable by the master. Formerly, however, this was not so, and it may be in certain instances they are legally recoverable now. Under such conditions, it has been asserted, and the writer believes with good authority, that the creation of "debt" has actually been encouraged by the employer. This has been the case where the workmen have been highly skilled, and there has been keen competition among the masters for the workmen's services. The fact then that the workman in the event of his leaving in "debt," could be prosecuted by his former employer, gave the latter a hold over him and prevented him accepting a higher offer of wages from another manufacturer. Such a state of affairs would, of course, only exist in a trade consisting of small employers, and it is impossible under the usual present day conditions of large factories. We must, therefore, consider the "debt" as being only a nominal or fictitious one, and, as a matter of fact, in the year's balance-sheet it is always written off as already lost and is never included among the credit items.

Effect of the "Balance and Debt" System on the Workmen.—The effect which this system has on the workman simply depends upon the mental attitude which the man is induced to take up. In some cases he accepts the situation frankly, and in the event of an accumulated debt does his level best to clear it off and again to earn balances. A particular case which came before the writer's attention at a machine tool works in Lancashire illustrates this. In this works the system was carried to the extent that if a workman left a job in debt it was a condition of employment of his successor that he should take up the debt and work the same off before drawing any balance. In the case in question the work consisted of the assembling and fitting of engine lathes, the work being undertaken by small groups of fitters under a leading hand. In this instance the leading hand took up the work with approximately £20 debt on it and in a comparatively short period paid the whole of it off and then earned very good wages. The secret of this was that the man was convinced that the prices paid were fair and had sufficient self-confidence to tackle the work with certainty of success.

As stated before, the mental attitude of the workman was the determining factor. It must be confessed, on the other hand, that often the effect of an accumulated debt is very different to the case just related. The workman then regards the debt as something impossible to be got over, and ceases to endeavour to work up to the piecework rate. This state of affairs is really the very worst which can exist in a workshop. If a man is working on a purely day rate, his sense of fairness will generally induce him to give a fair day's work in return for his wages. But a pieceworker up against a debt which has got out of his control neither has the sense of fair-dealing to urge him on nor the hope of increased wages. He speedily deteriorates as regards his own output and spreads disorganisation and dissatisfaction around him. Such a state of affairs must be put a stop to at all costs.

Difficulties of the "Balance and Debt" System.—In a preceding paragraph it was stated that when a piecework or bonus system was superimposed upon a day rate of pay, difficulties were encountered. If the work be purely repetitional, or simple in character, these difficulties to a large extent disappear. The state of affairs is soon reached when the majority of people in the workshop approximate to each other in output capacity, and are all working at the same day rate ; no "debt" worth speaking of is created, most of the people drawing large or small bonuses depending upon the energy and intelligence they put into their

work. It is when one comes to work of a varied nature, not of a repetition character, necessitating the employment of men of varying capacities and different day-work rates, that the difficulties appear.

For example: A certain job may be undertaken by a semi-skilled person who is rated, say, at 25s. per week. After some time spent on the work, he becomes highly skilled on that particular work, and earns, we will say, 32s. per week on piecework. Now, it might be necessary to place another man upon the same work to deal with a temporary rush. A man similarly skilled in that operation may not be available, and it may be necessary to employ a skilled mechanic, rated, we will say, at 40s. per week, on the job. Now this man, not having the manual dexterity on the particular work that the other has acquired by long practice, will, at the same piecework rate, go heavily into debt. It might be said that this should be prevented by increasing the day rate of the semi-skilled man to equal that of the trained mechanic and raising the piecework rate accordingly. But this would not be just. The skilled mechanic is paid at a higher day rate because the employer always has his trained skill available for any work which he might require. On the other hand, the semi-skilled man is only highly efficient on the particular job on which he has, by long practice, acquired rapidity of production. Any manager of a shop where work of a varied nature is carried on will agree that difficulties similar to the one just related are continually occurring. In short, when two men of different day rates are employed upon the same work, the one, because of his relatively higher day rate, goes into debt, and the other draws a balance.

Another difficulty which may be cited is that of new workmen, or workmen going on to new jobs. Of course, if the work is a continual repetition, this may be got over by not permitting the worker to go on to piecework until he has acquired sufficient dexterity to earn a balance at the settled piecework rates. This, however, is impossible in any shop where work of a varied nature is carried out.

It is not necessary to dwell upon this phase of the matter longer, as by following out the line of thought indicated, many other difficulties can be foreseen and are, as a matter of fact, encountered. As a result of these, various other systems of payment have been put into use in different places. These will next be considered. It may be said that they are all characterised by the absence of any "debt" being booked against the workman, the sole inducement to the exertion of the energy and intelligence of the workman being the hope of extra reward over and above his guaranteed daywork rate.

"Balance" System of Piecework.—This system is the same as the "balance and debt system," except that there is no such thing as debt. Of course the latter system comes to the same as the "balance" system alone if, owing to continuity of work, &c., all the pieceworkers continually draw balances, as is indeed the case in many works. In the "balance" system, however, even if the worker does not earn his day rate, his total of piecework being below this, nevertheless debt is not booked against him. On the next job he may earn a balance which is then paid him without regard to the fact that on the former job he may have been paid more than the piecework rating. The result of this is that the workman approaches each job afresh unburdened with the weight of an accumulated debt. It is obvious, however, that the system lends itself easily to abuse and necessitates careful supervision on the part of the foremen. Of course it is necessary for the workmen to keep time cards on which the time taken on every job is recorded. This is not always done with the "balance and debt" system.

Premium Bonus System.—In effect this is very similar to the "balance" system, in that the workman is paid as a minimum his day rate, and no debt is booked against him if he fails to do the work in the standard time. Instead, however, of pricing the work at so much per piece, a standard time is fixed within which the job should be accomplished. If the workman finishes within a shorter time, he is paid at his day rate for the time spent plus a bonus equal to this day rate for half the time saved.

This method of paying a bonus equal to half the time saved, although, of course, being quite an artificial arrangement and having no particular meaning, has resulted in the system being looked upon with suspicion by the workman, owing to the fact that he thinks that he is entitled to payment for the whole of the time saved. Consequently, the introduction of the system has encountered great opposition. It should be noted that the amount of the bonus depends upon the man's day rate. Thus, if he saves one hour and is rated at 1s. per hour his bonus is 6d. If, on the other hand, he is rated at 9d. his bonus is 4½d. In this the system differs from the fixed bonus system suggested below.

Differential Bonus System.—This is a system introduced in America and for which very excellent results have been claimed resulting in increased pay for the workmen, increased output and decreased cost of production. Some details of the working of the method are given in the *American Machinest*, Vol. 38, page 779. It is very similar to the premium bonus system described in the preceding paragraph, except that instead of the workman receiving as a bonus a fixed proportion of the time saved, the proportion is fixed by a sliding scale, it being the higher the shorter the time taken. There is, however, from the workmen's point of view the same objection as to the premium bonus system. To this must be added the difficulty that it is very complex and difficult for a relatively uneducated man to understand.

Exaggerated Results Claimed as the Result of the Introduction of Systems.—It is not out of place here to utter a word of protest as to the absurd lengths to which some writers have gone in claiming advantages for their different pet systems. This is particularly the case among the writers on the so-called "scientific management." The methods advocated by these writers are excellent as far as they go, but carried to the extreme lengths proposed by some authors, they only induce ridicule and contempt in practical men.

An example of this is afforded by a book written by Mr. Frederic A. Parkhurst, and entitled "Applied Methods of Scientific Management." One of these applied methods consists of very lengthy written instructions with the application of a bonus system to the charwoman. As an example, the eleventh and twelfth written instructions for the morning's work of this official may be cited :—

	Min.	*Hrs.*	*Bonus in dols.*
11. Thoroughly sweep the superintendent's office, dust the furniture and clean out wash basin; then return to locker room, taking the superintendent's cuspidor along. Thoroughly clean the same, leave pail and mop in its proper place, take broom along and return the superintendent's cuspidor, and continue to tool room	9	·15	·0075
Rest period, if wanted	12	·20	·010
12. Thoroughly sweep both departments of the tool room, remove chips, clean the hand basin in the corner, empty cuspidors, then go to die shop	24	·40	·020

and so on.

It is to be presumed that the charwoman in question carries about with her a copy of the instructions and refers to them from time to time to see whether she shall dust the superintendent's arm chair before she cleans his "cuspidor" or *vice versa*. When the office is spring cleaned, presumably, the standing instructions are withdrawn and a fresh lot prepared and doubtless passed by the directors as correct. It will also be good news to the "Weary Willies" that in the works in question a bonus may be earned by "resting." But the whole thing is of course absurd, and illustrates what an awful result happens to a man if he lets his mind be run away with by one idea.

Coming back to what was stated in the early part of this paper, all systems must be adjuncts to an efficient staff. System is like fire—a good servant but a very bad master.

Fixed Bonus System of Wage Payment.—The difficulties which are incident to the various systems hereinbefore described, may be, to a very large degree, got over by the employment of a system of fixed bonuses, depending upon quickness of production. In order to introduce this system, the shops are, first of all, divided into zones depending upon the average value of one hour's work in that particular section. A fixed bonus per hour saved is then settled for each zone. Thus, in Section 1, it may be agreed that the

bonus per hour saved shall be 6d. In Section 2, 5d., in Section 3, 4d., &c.

For each job, then, a time allowance is fixed, depending upon the time that would be taken by the average workman for that zone when working at a fair day rate velocity. The fixed bonus is then paid the worker for all time saved on the standard time, over and above, of course, his day rate of wages for the time spent. Thus, a man may be rated at, say, 10d. per hour working in a zone where the bonus is 6d. per hour saved. The standard time for the job is, say, five hours, and the workman completes it in $3\frac{1}{2}$ hours. He is paid $3\frac{1}{2} \times 10$ plus $1\frac{1}{2} \times 6 = 44$d., *i.e.*, at the rate of 12·6d. per hour.

In pre-estimating the selling price the labour costs would, of course, be reckoned at $5 \times 10 = 50$d., so that the final result should be a saving to the employer and an increased wage to the man. The particular point to bear in mind is that the bonus paid is totally independent of the time rating of the man. Thus all difficulties due to men working together on the same work at different time rates disappear. The question of whether the piecework rates fit in with the time rates of the workman never arises. Moreover, if the man be rated low and acquire special skill on a particular job the cost of production will be low, while the proportion of bonus to day rate drawn by the worker will increase and thus render him the more and more satisfied.

SOME CHIEFS I HAVE MET.

[COMMUNICATED.]

While the primary object of the technical Press is the dissemination of technical knowledge, at times an article dealing with more human and personal matters relieves the studied monotony of a plethora of technical articles, besides which personal experience dealing with employers and employés is often of great interest to those young men just entering upon a business career. It is, therefore, the intention of the author in this short article, to deal with the personalities of the chiefs under whom he has worked in the course of his career.

The writer's first essay in the supply world was made when he secured a junior post on the staff of a London company. The remuneration was the princely one of 30s. per week, and the recipient, being young and enthusiastic, persuaded himself that his services were worth at least four times that sum. After a few months' time, strenuous endeavours were made to imbue the chief with the same idea, but he was of adamant on the point, suggesting that "the honour of being attached to his staff was in itself sufficient remuneration for the poor services rendered." It was, therefore, necessary to explain that "the honour" did not provide the recipient thereof with shirts and collars, food and lodging, &c. As this argument had not the desired effect, and as the chief did not appear keen on continuing the discussion, it was deemed wise not to pursue the matter further, but to look out for a more remunerative post elsewhere. On a suitable post turning up, the chief was approached for a testimonial, which he declined unless the applicant undertook to resign within three months whether he secured another position or not. This arbitrary offer was declined, and the job-seeker applied without the recommendation requested. On receipt of the news that his application had been successful (jobs were easy to get in those days) the chief was sought in his private lair and informed of the fact. Rather a stormy scene followed, the chief maintaining that he had been treated in an underhand manner, that members of his staff immediately they became useful left, &c., &c. I mildly pointed out to him that if their usefulness had been recognised in a practical manner such eventualities would not have arisen. He, however, maintained a haughty and injured air, and thus we parted.

My next attempt was in municipal service. The chief was young, able and intensely enthusiastic and imbued with a tremendous sense of his own importance. The assistant he required was a man who never made mistakes or omitted "to do those things which he ought to have done or did those things which he ought not to have done." As this qualification is extremely rare in the case of young men of limited experience, and as what is right or what is wrong is often a matter of personal opinion, it will readily be understood that the position of the writer and his successors was an unenviable one, and my relations with this gentleman terminated very suddenly. On reviewing this episode in after years it became apparent that the fault lay on both sides, and that both chief and assistant should recognise that each is human. If this fact were more fully realised it would tend to the maintenance of harmonious relations, which would naturally be to the benefit of the undertaking. Enthusiasm is a quality to be commended in both chief and assistant, but when it is carried to the extent of asking an assistant, after 12 hours' strenuous duty to "come along and clean out the main flue" at 12 o'clock on Saturday night, the chief peeling himself for the fray as he issues his order, one feels that enthusiasm can on occasion be carried too far.

Out of a job, with but a few pounds in one's pocket, and too independent to seek the aid of the parental exchequer, the acquisition of another job was a matter of vital importance. However, success soon attended the writer's efforts. A certain municipal station was very short-handed, due to what in these days would be classed as a strike having occurred, owing to alleged tyranny on the part of the chief towards his subordinates. As the Committee wisely decided that discipline must be maintained, and as the inquiry held by the members into the alleged tyranny had a negative result, the strikers were requested to seek other pastures, and vacancies occurred. In view of this incident, the prospects of a happy life did not seem particularly bright; but as necessity knows no law, it was worth risking the supposed tyranny of the chief, knowing that one week's notice would terminate the engagement if the worst occurred. On arrival at the works I was cordially greeted by the chief; and I can understand his cordiality, as he and one assistant had for some time been running the station between them, while it was whispered that the synchronising during that period alarmed the drivers greatly. The interview was terminated by an invitation to partake of tea and bloaters at the chief's residence. This gentleman proved one of the nicest men one could possibly work under, always being genial and friendly, and quite willing to listen to any suggestions his assistants might make for the better running of the station. Unless he is like the leopard, it is hard to realise any circumstances under which he could be charged with tyrannical treatment of his subordinates. The salary paid the assistants was the usual "thirty bob," this being the arbitrary value placed upon our services by the Committee in spite of the remonstrances of the chief. He, however, frequently found his shift men a job in their spare time at 8d. per hour, and never worried them as to the length of time they took over the work. Therefore, if the engineers were not anxious to limit their time at the works to eight hours per day, it was quite possible for them to augment their income very considerably, in spite of the dictum of the Committee.

After a pleasant two years' sojourn, the writer secured an appointment as chief assistant at another municipal station. Here the chief proved a gentleman in every sense of the word. Unfortunately, however, the station was not paying, and the Corporation was very chary of launching out into a bigger scheme in view of the fact that substantial deficits were being made annually with monotonous regularity. The chief, a most capable man, was of quiet and unassuming demeanour, and, as one of the Committee told me privately, "too much of a gentleman, and unable to talk." He, soon after my advent, secured another position, and the Committee decided that it was desirable to introduce fresh blood. They quite made up their minds they wanted "a man who could talk," and, all credit to their discernment, *they got him!* Soon after his arrival he made things hum; he recommended practically everything his predecessor had advocated for years, and, strange to tell, these suggestions were adopted without a murmur. This gentleman eventually constituted himself Committee, Town Clerk and Corporation, as well as engineer, and declined to be guided by anybody,

completely ignoring the instructions of the Committee and Corporation. This policy worked well up to a certain point, but when these autocratic methods were adopted towards consumers and potential consumers, trouble was bound to follow, and the Corporation, while afraid to bring matters to a head, secretly longed for a return of the old quiet time—even if accompanied by the old bone of contention, the annual deficit.

The writer put in a very strenuous two years with the "talkative engineer," that gentleman leaving the work to his subordinates while he did the talking and took unto himself credit for everything done.

As to the sequel to this gentleman's career, in view of his vocal abilities, he required a great deal of "lubrication," and it came about that as time went on he spent most of his time at a local hostelry, boasting to members of the Corporation (who occasionally called and hinted regarding his frequent presence) that "He guessed he could do all his business by 'phone," pointing to the instrument in the bar parlour. This and other matters eventually became a matter of such publicity that the chief was compelled to resign, his post now being filled by a "mon o' few words."

THE PRIVATE INSTALLATION.

[FROM OUR LEGAL CONTRIBUTOR.]

THERE is often considerable doubt in the minds of those who are in a position to make and use their own electricity as to whether they can do so without encroaching on the preserves of the supply authority. Again, a difficult question often arises as to whether, when a man has an installation of his own, he can use the mains as a stand-by should his own plant break down. Finally, the man who is hardly in a position to run a private installation merely for the service of his own premises.

The Electric Lighting Act, 1882, does not make any provision at all for the regulation of the supply of electricity otherwise than under a provisional order or a special Act. Thus, after that Act was passed, whereas persons who supplied electricity under a provisional order were subject to rules made by the Board of Trade in carrying out the details of their undertaking, the owners of an installation who furnished their neighbours with a private supply were under no restriction whatever. For instance, by regulations made under the Act of 1882, the use of aerial lines was very much restricted; but these rules only applied to statutory undertakers.

In order to bring private supply companies under the jurisdiction of the Board of Trade a special clause was inserted in the Act of 1888. By Sec. 4 of that Act it was provided that where in any case any electric line or other work may have been laid down or erected in, over, along, across, or under any street, for the purpose of supplying electricity, or may have been laid down or erected in any other position for such purpose, in such a manner as not to be entirely enclosed with any building or buildings, or where any electric line or work so laid down or erected may be used for such purpose otherwise than under and subject to the provisions of a licence or provisional order, the Board of Trade may, by notice served upon the body owning or using the line, require that such line shall be continued and used only in accordance with the conditions and rules which they may prescribe.

A proviso exempts from the operation of the section "every electric line or work laid down or erected by any body or person for the supply of electricity generated upon any premises occupied by such body or person to any other part of such premises." Thus a man who erects an installation for the supply of his own house, or factory premises need pay no attention to the regulations. Any person failing to observe the regulations and orders of the Board of Trade is subject to penalties.

To avoid the necessity of drawing up sets of rules for every case, the Board of Trade have issued regulations drafted to meet the requirements of this section, the general effect of which is very similar to those which have to be observed by companies and local authorities which supply electricity under statutory powers. To deal with them at length would be beyond the scope of the present article. It may be pointed out, however, that Regulation 2 prohibits earth connection, except in the manner there provided. Regulation 4 limits the pressure between any two conductors or between any part of either conductor and the earth, to 3,000 volts. Regulation 14 substitutes 100,000 watts for the 3,000 volts in the ordinary regulations as the limit which a high pressure line may be used for transmitting. Regulation 17 provides precautions against injurious affection by induction; while Regulation 18 contains special provisions for the protection of the Postmaster-General.

Compliance with the Board of Trade regulations does not always completely protect a man who supplies electricity in the manner above described. He may have to observe certain by-laws issued by the local authority of the district in which his works are situated.

Thus he may find it necessary to lay his mains across a highway, and in seeking to do this he may come into conflict with the local authority who have control of the highway. This will probably be the case if the local authority are themselves supplying electricity in their district under provisional order, as they will naturally desire to restrain competition by every means in their power.

Dealing first with the question of overhead wires, it is clear law that unless the local authority own the soil of the highway, they cannot entirely prevent the suspension of overhead wires if placed at such a height that they are completely out of the way of the traffic. This point was made quite clear some years ago in a case which was decided in the High Court. Those who wish to lay cables across the highway have only to make an arrangement with the landowners on either side by which they can obtain leave to erect posts for the suspension of the cables. In the rare case, however, of the local authority owning the soil of the road, it will be within their power to absolutely prevent any cables being so suspended, as the presence of such cables constitutes a technical trespass, the continuance of which may be restrained by an injunction.

It should also be observed that in urban districts the local authority, by adopting Part II of the Public Health Acts Amendment Act, 1890 (53 and 54 Vict., c. 59), may acquire power to make by-laws for the prevention of danger or obstruction to the public from posts, wires, tubes, or any other apparatus stretched or placed above, over, along, or across any street (whether before or after the adoption of that part of the Act), for the purpose of any telegraph, telephone, lighting, railway signalling, or other purpose. Again, in the case of London, overhead wires can only be erected in accordance with by-laws made under the London Overhead Wires Act, 1891.

Coming now to the question of laying mains beneath the surface of the road, it may be stated, broadly, that no private person has any right to break up the surface of the road without the consent of the highway authority. Further, there is a section of the Public Health Act, 1875, which prohibits any man from placing a tunnel of any kind under a highway without consent.

Having dealt with the conditions in which a private supply installation may be conducted, it is now necessary to take note of recent legislation dealing with the matter. The legislature appears to have been compelled to wait for 10 years before it was found possible to add anything to the Act of 1899.

The first section in this Act (Sec. 15) which is material to our present purpose deals with the question of supplying electricity to premises having a separate supply. It is in the following terms:—"Notwithstanding anything in the Electric Lighting Acts or in any Act of Parliament or Provisional Order authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity in any area a supply of electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for these premises; the sum

to be so paid shall be determined in default of agreement by arbitration."

The necessity for some such section arose from the fact that before this Act was passed it was quite competent for the owner of a private installation to use the "mains" when there was a breakdown. He could not be refused a supply simply because he happened to have an engine and dynamo of his own. But for this section undertakers could not insist upon a minimum sum in excess of that authorised by their order, which is usually 13s. 4d. per quarter.

But, perhaps, the most important section in this Act from the point of view of the owner of a private installation is Sec. 23, which deals with the question of competition between the owner of a generating plant who desires to supply his neighbours, and the local or other authority supplying under, or by virtue of, a provisional order.

The Section provides: "Where in any area a local authority, company, or person is authorised to supply electricity under Act of Parliament, or under licence or provisional order, granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company, or person to commence to supply or distribute electricity within the same area, unless such supply or distribution is authorised by Act of Parliament, or by licence or provisional order granted in terms of the Electric Lighting Acts: Provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers.

"Provided also that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic."

The second proviso will become of less and less value as time goes on. It is interesting to notice that since the Act came into force, no case has arisen in which this section has been discussed, or in which any attempt has been made to enforce it. Indeed, it is not easy to understand how or by whom it is to be enforced. Apparently it would be for the local authority or company to institute proceedings for an injunction to restrain interference with their rights. But there is nothing to show that a ratepayer in a district might not himself move in the matter on the ground that the possible competition would tend to diminish the profit of the public undertaking.

In conclusion, we may refer to one question which often arises. Suppose a man were to take a supply from the station at power rates. By so doing he would thus get the current at a less cost than he would have to pay if it was used for lighting purposes. He could well afford to have a motor-generator and supply himself and his neighbours with electric light. Would this be legal? It is conceived that any such use of a motor-generator is illegal. For a man to take a supply of electricity at motor rates and use it for lighting purposes is little short of a fraud on the supply company.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prevention of Accidents in Electric Lifts.

Absence from England for some weeks has prevented the writer from following the above correspondence, but, perhaps, it is not yet too late for another letter.

"Helicon" (July 4th) correctly states that on June 27th Mr. Cooper and Mr. Barlow defined the danger in Mr. Cooper's mind, but they had not previously done so. "Helicon" incorrectly assumes that this danger as now described was "obscure" to us. He overlooks the fact that we referred to it in our first letter, and to means for avoiding it, and reverted to the latter point on June 27th.

"Helicon" proposes that closing the switch should come last in order of time. This is a most attractive ideal, and one which has probably presented itself to more than one student of the subject. But everything depends on what has to be sacrificed to attain that particular object; in short, upon the complete details of the project, and until these are stated no useful opinion is possible.

"Helicon" again refers to a possible broken spring, and adds a bent spindle as impediments to counterlocking. The former has been dealt with, and as to spindles, they were eliminated from any locks years ago.

Turning to Mr. Cooper's letters, that gentleman opened the discussion by a condemnation of all existing locks, and laid down a specification as his own ideal, which, he stated, was conformed to by a single "unique" specimen, since identified as Mr. Barlow's.

We were able to show that at least three other types, including one of our own forms, filled the bill, and recently particulars of a fifth have reached us. Was not Mr. Cooper's generalisation a trifle rash?

On June 27th this correspondent again condemns springs as being inferior to . . . some device he leaves undescribed. In the same letter he objects to discussion when "no definite particulars are available." He is really very difficult to please.

He expresses a doubt if we understand his specification. We can assure him we do, and met it long ago.

His attempt to place us in a dilemma in respect of our 1905 patent merely indicates inexperience of patent procedure. In point of fact, only one lock was ever made in accordance with the illustration published in the specification, but most of those actually manufactured are protected by the 1905 claims.

His sneer at our policy of prompt improvement at all possible points was, no doubt, regretted when seen in print, and we set against it the later admission that until a few weeks back our 1905 patent was "the best on the market."

Mr. Cooper is wrong in his assumption that we have dropped the form of lock which meets his specification; it is supplied to any customer desiring it.

Mr. Cooper's argument round a recent fatality is getting confused. He was objecting to the uncounterlocking of each, or any, gate at a point before the cage reached floor level, and used the accident to point his objection. We replied that an uncounterlocked zone of 2 ft. 6 in. was a practical necessity, and stated that the accident was not the result of such a provision. He now quotes evidence (the accuracy of which we neither accept or dispute), which, if correct, merely shows that by some mischance the uncounterlocking occurred very much earlier; and, therefore, that the circumstances are not relevant to this discussion. Uncounterlocking must occur somewhere, and all systems are liable to derangement.

The main question was, whether Mr. Barlow's lock was an advance upon previous achievement, and clearly that cannot be usefully discussed till the inventor can table his particulars, and we therefore wish this to be a final letter.

We have shown that things were not so backward as Mr. Cooper imagined, and would close with a reminder that he was comparing a device which had passed through the ordeal of thousands of applications during eight years of life with the one which was, however promising, as yet comparatively untried, and we have some confidence that after two or three years' experience of the new device, if Mr. Cooper cannot repeat his opinion that ours was the "best on the market," he will, at least, look upon it as second to none.

Smith, Major & Stevens, Ltd.

London, *August 1st*, 1913.

A Question of Etiquette.

I am anxious to obtain the opinion of some of your readers as to what is the proper course to pursue under the following circumstances.

During my journeyings about Great Britain I have come in contact with several supply companies who make a big profit out of installation work and who stifle competition by insisting on all sorts of absurd regulations (bluff, of course, but rows only make customers suspicious) for contractors;

at the same time these same companies do disgraceful work themselves, *i.e.*, bare wires under floors and down partitions, motors, &c., unearthed, and all the other shifts of jerry wiremen are made use of.

Do your readers think that it would be unprofessional to call the attention of the Board of Trade inspectors and the fire offices to this wherever it is found?

J. Riley.

Inverness, *July 29th*, 1913.

Dry and Wet Air Filters.

As owners of patent No. 19,792 of 1912, which fully covers the application of water spray air filters to electric generators, we were interested in Mr. H. R. Witting's letter in your issue of the 1st inst. The various technical points raised by Mr. Witting, questioning the suitability of the water spray system of filtering the air supplied for cooling electric generators, were practically all covered in the remarks made by Mr. Feldmann and Mr. Bennett during the discussion of Mr. Christie's paper at the recent annual meeting of the Incorporated Municipal Electrical Association. They were so fully replied to at that time that there appeared to be no doubt left in the minds of the majority of those present as to the practical success of the water spray system, but, of course, whether it will be largely adopted remains to be seen. We have built for many years, and are still building, dry air filters for various purposes, but from recent experience we are convinced that the water spray system is far superior for electric generator work.

Sturtevant Engineering Co., Ltd.
Geo. A. Mower, *Managing Director.*

London, *August 5th*, 1913.

CO-PARTNERSHIP.

The Board of Trade is pursuing the subject of co-partnership with admirable tenacity of purpose. A Bill to promote the adoption of co-partnership by statutory, and other companies, has been introduced to the House during the session which is now drawing to a close, of which the following is a memorandum:—

The Companies' (Co-partnership) Bill represents a tentative effort to encourage the principle of co-partnership in the industrial life of the country. The main objects of the Bill are first to enable companies to adopt co-partnership in cases where they would otherwise be debarred from doing so, either by their private Acts of Parliament, or their articles of association; secondly, to set out in the form of a schedule a model scheme of co-partnership for their voluntary adoption; and thirdly, to provide that such model scheme shall ordinarily be a condition for granting statutory power to new companies to raise capital, though, of course, without attempting to fetter the discretion of Parliamentary Committees in individual cases. Under this scheme, certificates of partnership in the objects of the company, and a share in its surplus profits, are to be granted to all persons in its regular employment. It is provided that the standard rate of wages shall be taken to correspond with a standard return of 5 per cent. on all paid-up capital, and when the return is higher than 5 per cent., the employé becomes entitled to a bonus calculated at one-twentieth of his existing wages for every extra 1 per cent. paid in dividend. Thus, a company with a paid-up capital of £100,000 and a normal wage-bill of £20,000 would, if it paid 6 per cent., have to give its employés an extra £1,000 or £21,000 in all; if it paid 10 per cent., £25,000; and if it paid 15 per cent., £30,000. Similarly, a workman with a standard wage of 30s. a week would get 31s. 6d. on a dividend of 6 per cent.; 37s. 6d. on a dividend of 10 per cent., and 45s. on a dividend of 15 per cent. As, however, it is not desirable that the whole bonus should be paid over in cash, it is provided that trustees shall be appointed, to whom, at least, half the bonus shall be paid, and by whom it shall be invested, if possible, in the shares of the company itself. Further, in order to meet the varying circumstances of different industries, it is provided that in the case of registered companies the Board of Trade may allow other regulations to be substituted in individual instances, and, in particular, may allow a lower rate of bonus when salaries and wages bear a specially high proportion of the annual cost of the business of the company. There are also provisions for the election of trustees and directors and for the adjudication of differences.

The Bill provides that the Companies' Clauses Consolidation Acts, 1845 and 1888, shall be amended by the addition to them as a new section of the words: "The company shall have the power to grant and shall be under the obligation of granting certificates of partnership to persons in its employment according to the regulations set forth in the schedule to the Act." Every company incorporated by Act of Parliament and every company registered under the Companies' (Consolidation) Act, 1908, is (if not already so empowered) to be deemed to have power without further authority of Parliament or application to any court to grant certificates in accordance with the regulations contained in the schedule, provided that the company may, with the consent of the Board of Trade, substitute other regulations for these in the schedule, and may in particular substitute some other figure for the figure 5 per cent. per annum as the rate of bonus in Regulation 4 of the schedule regard being had to the proportion borne by salaries and wages out of the total annual expenditure of the company.

The schedule containing the regulations provide (*inter alia*) that the company shall offer the certificates of co-partnership to all persons in its regular employment within the United Kingdom, and that every person shall be deemed to be in the regular employment of a company, who, having worked in its service for three months in any year, is willing within the ensuing three months to sign a contract of service with the company for a further six months on conditions similar to those under which he has already worked, or on conditions which may be agreed between him and the company.

Every certificate of partnership is to entitle the co-partner to a bonus called the co-partnership bonus at the expiration of his contract of service or on his ceasing to be employed by the company, calculated at the rate of 5 per cent. per annum on his salary or wages, for every 1 per cent. above 5 which has been paid by way of dividend, bonus, or interest by the company during its last financial year on the total capital employed in its business.

The co-partners shall in each year elect to be directors of the company, such number of persons not exceeding one-third of the whole board of directors, as may be agreed upon between themselves and the remaining directors, and any director so elected shall enjoy the same rights, privileges and remuneration as any other director, not being the chairman or a vice-chairman or managing director of the company.

There is to be constituted a body of three trustees, of whom one shall be the chairman of the company, one shall be elected annually by the co-partners, and one annually by the board of directors.

The company may pay to the trustees one half (or in the case of a co-partner who so desires the whole) of the co-partnership bonus in any year, and they shall pay to them any portion of the said bonus which may exceed 25 per cent. of the salaries or wages of the co-partners in any year. The sum so paid is to be carried to a special account and proportionally credited to the individual co-partners as from the expiration of the company's last financial year, and is to be invested for them by the trustees either

(*a*) In securities in which trustees are allowed to invest under the Trusts Amendment Act, 1884, the Trustee Act, 1893, or the Colonial Stock Act, 1900, or

(*b*) With the consent of the co-partner in stock or shares of the company itself.

It is further provided that any company which has any part of its capital unissued, may, in lieu of paying any amount not exceeding one-half of the co-partnership bonus, make an issue out of such capital to any co-partner with his consent, and any sum required to be paid in respect of such issue shall be deemed to have been paid by the co-partner, in so far as it does not exceed one-half of the co-partnership bonus to which he is entitled. Provision is made for the voting of co-partners, and, finally, the company may cancel the certificate of partnership in the case of any person who ceases to be in their regular employment for whatever reason. The trustees may, and shall, on his demand, hand over to such a person any sum standing to his credit, and also any share certificates or other documents proving his right to the securities in which they are invested on his behalf, and upon such sums, certificates or other documents being handed over, the liability of the trustees in respect of such co-partner ceases and determines.

INCREASE IN RAILWAY RATES IN CONNECTION WITH THE ELECTRICAL TRADE.

[COMMUNICATED.]

Although it is practically common knowledge that railway rates have been increased from July 1st, 1913, many of our readers may not know much concerning the inner working of the new Act, so that a few words on the subject may be of interest to those electrical manufacturers and others who forward, or receive, goods over the railway.

There will possibly be an outcry all over the country about the higher rates, as there is little doubt that any increase will greatly affect many trades, and especially the electrical engineering trade. One of the reasons for this is that there are a great number of special or exceptional rates (these rates being lower than the class rates) in force for dynamos and other electrical machinery, and the railway companies' present intentions are that only the special rates shall be increased. We contended some years ago that electrical manufacturers had a grievance against the railway companies for not granting them the same facilities and concessions with regard to cheap rates as were allowed to other traders. Now, when the electrical trade are securing fairly easy rates for the transport of their goods, up goes the special low rates

which they have only derived benefit from for about five years. Dynamos and motors in cases were at one time charged at the second-class rate, which, as an illustration, comes to, say, 40s. per ton. Upon repeated application by certain traders, the railway companies agreed to allow the traffic to come under the Special Rate (which applies between many large centres) for machinery. In this particular instance the special rate was 30s. 8d., so that the reduction was very beneficial to a trader who had to meet foreign competition. Whilst the ordinary class-rate will not be increased, as the railway companies now propose to let it (and all other class-rates) remain stationary, the special, or exceptional rates, will be increased by 4 per cent. A clear idea of the matter may be gained from the following :—

Extract from the Act respecting increases of rates or charges made for the purpose of meeting a rise in the cost of working a railway due to improved labour conditions.

I. (1) Where on a complaint with respect to any increase (within any limit fixed by an Act of Parliament, or by a Provisional Order confirmed by an Act of Parliament) of any rate or charge, under Sec. 1 of the Railway and Canal Traffic Act, 1894, the railway company proves to the satisfaction of the Railway and Canal Commissioners :—

(*a*) That there has been a rise in the cost of working the railway, excluding the cost of carrying and dealing with passengers, resulting from improvements made by the company since August 19th, 1911, in the conditions of employment of their labour or clerical staff ; and

(*b*) That the whole of the particular increase of rate or charge of which complaint is made is part of an increase of rates or charges made for the purpose of meeting the said rise in the cost of working ; and

(*c*) That the increase of rates or charges made for the purpose of meeting the said rise in the cost of working is not, in the whole, greater than is reasonably required for the purpose ; and

(*d*) That the proportion of the increase of rates or charges allocated to the particular traffic with respect to which the complaint is made is not unreasonable : the Commissioners shall treat the increase of rate or charge as justified ; provided that nothing in this section shall be construed as preventing the Commissioners from taking into account any circumstances which are relevant to the determination whether an increase of rates or charges is or is not greater than is reasonably required for the purpose of meeting the said rise in the cost of working.

(2) Where it appears to the Commissioners that the increase of the rate or charge of which complaint is made should for the time being be treated as justified in pursuance of this Act, but that an opportunity should be given after a limited time for reconsidering the increase, they may, in making an order declaring the increase to be justified, add to their order a provision that the question may, after a period to be fixed by the Commissioners, be reopened in accordance with the conditions (if any) made by the order.

(3) Where any such order is made, a complaint may be made as to the increase of the rate or charge under the Railway and Canal Traffic Act, 1894, in accordance with the order of the Commissioners, notwithstanding that the matter has already been determined by the Commissioners.

II. This Act shall not apply to Ireland.

Although the above Act already provides for an increase in all rates where necessary, the railway companies have decided not to increase the class rates, but as already stated only the special rates, and steps will be taken to ensure that the 4 per cent. increase will be equal to, or below, the statutory charges. To prevent mistakes the railway companies have issued the following instructions to their staffs :—

"The rates so charged must not in any case exceed the class rate for the particular commodity concerned, and where the addition of the full increase, as set out above, would result in a higher rate than the class rate, then the class rate must be charged. The increased rates will apply with the same conditions as the existing rates unless the increase results in the class rates being charged, in which case the conditions attached to the class rates will apply. These instructions do not apply to coal and coke, which will continue for the present to be charged at existing rates, or as may be specially advised from time to time."

We are quite aware that railway companies have to pay dividends the same as private traders, but we consider that a 4 per cent. increase on the rate for railway carriage on practically on all electrical plant, may greatly affect the manufacturers' profit.

Seeing that special rates are in operation all over the country for electrical goods, it is easy to understand what difference this 4 per cent increase will make to the carriage on any long-distance traffic, say, from London to the North, especially so on the following goods, which are all generally charged at special rates :— Armatures, commutators, dyamos, electric controllers, electric switch boxes, transformers and coils, end plates for generators, field coils and other parts of general magnets and limbs, motors, rheostats, &c.

In conclusion, it may be said that although these increased rates may seriously handicap the electrical industry, little good can be done by agitating for lower rates, until the Government and traders have seen the effect of the Act upon the railways and trades of the country.

Crystal Palace School of Practical Engineering.—

Mr. W. B. Bryan, Chief Engineer of the Metropolitan Water Board, distributed the certificates, &c., at this school on July 31st.

PROCEEDINGS OF INSTITUTIONS.

Wind-Power for the Generation of Electrical Energy.

In the course of a paper on this subject by Mr. W. H. Myers, read before the Electrical Association of New South Wales, the author referred at some length to an installation on the Child system at the house of Mr. P. Waite, near Adelaide, which had been in continuous operation for over two years, with complete success. The author had inspected the plant, and gave the following particulars :—

"The voltage regulation in this instance is only partially obtained by the speed control, a neat system of relays on the main switchboard varying the shunt field resistance so as to further regulate the voltage. Provision is made on the switchboard for the battery to be automatically connected to the generator at full normal voltage (110 volts), and for either half of the battery at half voltage, so that further advantage may be obtained from the lower wind and wheel velocities. End cell regulation is also provided, and the system of supply is three-wire. The wind wheel is 18 ft. diameter, on a tower 60 ft. high. The generator is of 2·5-KW. capacity, with a maximum speed of 1,600 R.P.M., and is shunt-wound. The battery consists of 54 cells of the Tudor type, of a 324 ampere-hours capacity at the three-hour rate. The total number of lamps connected is over 100 of varying candle-powers, and the actual average output (which is metered) amounts to about 3 KW.-hours per night. The plant is also used to operate three flat irons, one radiator, one 1-H.P. motor driving a cream separator, some fans and for occasionally charging the battery of an electric motor-car ; this latter supply, however, is not all derived from the windmill. I was informed that the wind-power was amply sufficient for requirements and that, with one exception recently, no mechanical troubles whatever had been experienced. This defect was due to a broken ball in the ball races of the main bearing, and, therefore, in no way belittles the very excellent mechanical design and construction of the plant.

"As a matter of interest, it was noted from the log-book which has been kept that the maximum energy generated in any one day amounted to 16 KW.-hours, although figures of 13 and 14 KW.-hours were commonly obtained. The area of each of the tail vanes is 16 sq. ft. (4 ft. × 4 ft.). About 30 gallons of distilled water are used in 12 months for topping up the battery, and the only other item involving attendance is the adjustment of the Stauffer grease cups, about once per month.

"I saw no sign whatever of wear and tear on the plant, and the battery, as mentioned later, is in excellent condition."

From data he had obtained, he found that in Sydney the average wind velocity was about 8·8 miles per hour ; one could be reasonably certain of velocities averaging 10 M.P.H. or more for fully one-half of each month, and 15 M.P.H. or more for one third of each month. No longer period than four days was on record at Sydney during which a wind velocity of 10 M.P.H. or more did not occur. New Zealand was still more favourably situated in this respect than Australia, as in some districts strong winds blew for weeks at a time.

I.E.E. Students' Tour, 1913.

After several years of tours abroad it was decided this year to hold the annual tour of the Students of the Institution of Electrical Engineers in this country, and Newcastle, the home of the most recently formed Students' Section, was selected. The party left London on Thursday, July 3rd, by the night train, arriving with the early dawn in Newcastle. The first visit was made the same morning to the Elswick works of Messrs. Armstrong, Whitworth and Co., which employ over 20,000 hands. Attention was paid particularly to the ordnance and electrical departments.

In the afternoon a purely "electrical" visit was made to Messrs. Reyrolles. The name is synonymous with switchgear, and in the course of a long visit there was not much missed in that line. An explosion-proof box had been arranged for demonstration ; it was filled with a mixture of air and gas, and then fired with the lid bolted down and with the lid loosely laid on. Flame is prevented from passing outside the box by leaving the flanges roughly machined. The gases can escape through the interstices, but the cooling effect is so great that all flame is extinguished ; in fact, a cold blast is felt on holding the hand beside the flanges when an explosion occurs. When the lid was not bolted down, but merely laid on the box, an explosion of similar intensity lifted it clear of the box and the flame spread all round. The high-tension testing set was next exhibited working up to 100,000 volts, together with its safety switches. Other interesting features were the starting rheostats, with elements made up of metal and compressed carbon powder. The latter, having a negative temperature coefficient, allows the current to grow at a steady predetermined rate, and prevents any excessive rushes. The visitors were entertained at tea by Mr. Clothier, honorary secretary of the Newcastle Section, and several of his staff.

Next morning saw the party early astir to visit Messrs. Parsons's turbine works at Heaton. The outstanding object was the 25,000-KW. set for Chicago, and the machines ranged downward in size from this to a 15-KW. set. The rolling of turbine blades to their finished section in long strips was interesting, and the skill exhibited in the hand-work of straightening the strips was striking. This is really a new trade. A cable-making machine which wound the wires into a flat strip was also seen here ; it was of the same general type as the ordinary machine, but was provided with a flat blade as the core piece, off which the finished cable was drawn.

This arrangement obviates the flattening of the cable to fit it into the slots, thereby preventing damage to the insulation.

In the afternoon a visit was paid to the Harton Colliery, which has a complete electrical equipment. Mr. Georgi, the consulting engineer, conducted the party around the gear at the pit head. The supply is taken from "The" Power Co. (there is only one in that part of the world) at 5,700 volts direct to the winding motors, the most noticeable of the latter being the large Siemens motor at the New Pit. The working face is 2 miles from the shaft, and all the underground haulage is by cable and electric motor.

Next morning saw the party on the way to Carville, but this station is too well known to need any further mention. Perhaps the most interesting part was the control room, where the whole system is laid out diagrammatically, and indicators are provided showing how all the feeders, switches, &c., are connected up, whether alive, and so on. This provides for the complete control of the whole system, extending over 1,400 sq. miles, being in the hands of one man. Another point noticed was the small expenditure on buildings.

The afternoon was devoted to relaxation; the Newcastle Section had arranged for a sail down the River Tyne to Tynemouth, and the visitors joined in. At Tynemouth a brief visit was made to the lighthouse, where vaporised oil and mantles of 1,000 c.p. hold sway, with a 200-c.p. electric lamp as stand-by and oil lamps as a further stand-by. An electric motor, however, is normally used to compress the air for the foghorn and oil feed, there being an oil engine as stand-by. There followed tea and a smoking concert, under the chairmanship of Mr. C. Vernier, supported by Mr. H. W. Clothier, Mr. Georgi and others, the party returning to Newcastle by train.

Sunday morning was occupied by a visit to Dunston, the new station of the power company. This visit was arranged by Mr. Cusworth, of Carville, for a few who were able to stay at short notice, and it was well worth staying for. The switchboard and control house is situated in a separate building about 100 yards from the engine room. The boiler house is as clean as the average station, owing to the use of the suction ash ejector. The ash and clinker are pulverised and dropped into a vacuum tube that removes them and leaves no trace. In the yard were seen some under-running live-rail shields on test, destined for South America.

The welcome and assistance given by the Local Section to the visitors (Mr. Henniker, the students' secretary, needs special mention in this respect) were very well appreciated, and it is believed that the system of visiting a local section, or of the latter visiting London for that matter, is well worth continuing.

LEGAL.

Municipal Wiring Arbitration.

An arbitration recently took place between the Corporation of St. Marylebone and Capt. H. Ramsden, a member of the Council, regarding an account sent to Capt. Ramsden by the sales department for the wiring of his house, the amount of which was in dispute. Mr. R. W. Weekes acted as expert adviser to Capt. Ramsden, and reported that the charge (£76 10s. 6d.) was excessive, and that the work was badly done and ought to be done afresh. The parties agreed to refer the matter to Mr. Albion T. Snell, who, after hearing evidence on both sides, made an award to the effect that £76 10s. 6d. was not a fair price for the work done, but that £48 2s. was a reasonable charge; that having regard to all the circumstances the work had not been carried out on a suitable system nor with the best workmanship, and was not in accordance with the wiring rules of the I.E.E., and that it should be done with enamelled screwed steel tubing on the draw-in system, with 600 megohm grade cables not less than 3/22 S.W.G., no lamp circuit serving more than 10 lamps.

The Corporation was required to pay £30 2s. 6d. for the arbitration fees, £26 5s. to Capt. Ramsden towards his costs, and the costs of it's own expert evidence.

Lambourne & Co. (Manchester), Ltd. *v.* Estin Sheet Galvanising Co., Ltd.

Before Mr. Justice Rowlatt, in the Nisi Prius Court at the West Riding (Yorks.) Assizes, the plaintiffs sought a declaration that they were entitled to be indemnified by the defendants against liability which they (the plaintiffs) had incurred under the Workmen's Compensation Act, 1906. The liability was incurred in respect of compensation for injuries sustained by one of the plaintiffs' workmen.

Mr. E. T. Atkinson, K.C., and Mr. C. F. Lowenthal were for the plaintiffs, and Mr. M. Innes, K.C., and Mr. Mortimer for the defendants.

Plaintiffs' case was that one of their employés (Robt. John Wileman) while engaged upon the work of building two steel-framed sheds for the defendants at South Bank came into contact with a "live" electric wire, which the plaintiffs alleged had been fixed by the defendants for their own purposes, and was in no way connected with plaintiffs' contract. They further alleged that the wire was negligently fixed in that it was not insulated. The plaintiffs had admitted their liability under the Workmen's Compensation Act, and from the date of the accident in November, 1912, they had compensated Wileman at the rate of 19s. 3d. per week down to the present time. They now sought to have it established that the man to whom they had paid compensation was injured in circumstances involving a legal liability on the part of the defendants to pay indemnity to the plaintiffs.

The defence was a denial that the defendants were guilty of the negligence alleged, and a denial that Wileman sustained his injuries by contact with a "live" wire. They contended that the man was hurt by slipping or overbalancing himself while standing on an angle bar. Alternately they submitted that the man was guilty of contributory negligence.

The evidence was largely technical, and models illustrating the manner of the accident were brought into Court.

His Lordship gave judgment for the plaintiffs.

The X.L. Electric Company *v.* Aron.

On July 30th, Mr. Justice Neville had before him a motion by the plaintiffs in the action of the X.L. Electric Co. *v.* Aron to commit the defendant for breach of an order made on June 20th last.

The litigation arose over an agreement of assignment of certain patents to the company by Mr. Aron, the inventor, and the order made on June 20th was to restrain him from delaying or preventing, or from permitting to be delayed or prevented, certain patent rights subject to the agreement.

Mr. Simmons, for the defendant, took the preliminary objection that service of the notice of motion, which was for the previous day was bad, as it was served for a day not appointed for motions and did not bear on the face of it that the service was by special leave.

Mr. Peterson, K.C. (with him Mr. Moritz) supported the service, but his Lordship upheld the preliminary objection and refused the motion. Leave was, however, given to serve a fresh notice of motion for the following day.

On the motion coming on on July 31st, Mr. Peterson said he did not desire to press for an attachment, all he wished to do was to protect the patents assigned to the company. If the defendant would do what was required of him the company had no wish to press the motion.

Mr. Simmons asked for an adjournment. New affidavits had, he said, just been served upon him, though the plaintiffs knew all about the matter more than a fortnight ago. The order was made on June 20th, and the company knew the requirements of the Patent Office on June 25th. He asked that the motion might stand over until the first sitting of the Vacation Court (Wednesday, August 6th).

His Lordship said that when he gave leave to serve short notice of motion for that day, he did so to cure an irregularity. He did not intend that fresh evidence should be filed.

Mr. Peterson said he felt some difficulty in proceeding with the matter as it stood, and assented to an adjournment.

His Lordship said he would direct the motion to stand over until the following Wednesday, and give the plaintiffs leave to amend their notice of motion by asking in the alternative for an order to enforce the agreement.

Mr. Simmons asked for costs, and his Lordship said he would reserve the costs. Mr. Simmons submitted that he was entitled to the costs of the motion on the previous day, which had been refused, but his Lordship said he would reserve all the costs. Mr. Simmons asked that they should be reserved to be dealt with by his Lordship personally, not by the Vacation Judge. Mr. Justice Neville said he could not do that. If the Vacation Judge disposed of the motion he must deal with the costs.

The motion was accordingly adjourned, all costs being reserved.

Muir *v.* Chambers.

At the Suffolk Sheriff's Court, a jury assessed the damages in this slander action at £200. Plaintiff, Thomas Muir, is foreman electrician for Messrs. Ransomes & Rapier, Ltd., Ipswich, and defendant, Edward Chambers, was described as a labourer, at one time employed by the firm. Plaintiff claimed that he was much injured in character, credit and reputation by slanders (imputing gross dishonesty, &c.) written and spoken by defendant to the managing director of the firm mentioned.

Torquay Turret Clock.—The large turret clock in the tower at Torquay Town Hall was formally started by the Lady Mayoress on July 30th. This clock has four dials, each 5 ft. 6 in. in diameter. Mr. A. E. Ball, representing Messrs. Gent & Co., Ltd., of Leicester, the makers of the clock, presented the Lady Mayoress with a golden key in the form of a brooch as a souvenir of the occasion. A large installation of Parsons-Sloper secret telephones is also installed in the Town Hall.

Patent Restoration.—An order has been made restoring Letters Patent No. 22,819 of 1908, granted to Thomas John Murday for "Improvements in primary electric clocks."

E

BUSINESS NOTES.

Lead.—Although the lead market showed something of a reactionary disposition in the latter part of last week, there was no reason to be assigned for the backward drift, beyond the fact that it arose from a desire to realise over the holidays. True, there had been a little selling from a somewhat unusual quarter, which was regarded as coming from bears; and the mere fact that attempts were being made to put out short sales was quite sufficient in such a market as that of lead to cause a sharp reaction. Lead has always a narrow market, and the article is often very difficult for a comparative outsider to deal in. Hence the irregular movements occasionally seen even when everything is actually quite sound. As regards the technical position, there is no doubt a considerable oversold account to be adjusted sooner or later, and this is a feature which may in time assume a rather important phase. So far as relief is to be expected, there seems to be not the smallest chance of Mexico contributing to it, for all reports from that distressful country are of the most disquieting character. There has been a very fair run of new demand lately for near deliveries, and some of the big cable people appear to have been in a rather tight place for immediate deliveries, though the tendency has since slackened somewhat. It is no use closing the eyes to the fact that the real position of the article, apart from the day to day fluctuations experienced, and arising from purely local considerations, is one of unabated firmness, and it is only when fundamentals undergo a modification that the intrinsic position of the article will be weakened.

Installation Contracts.—Messrs. Barnets & Soans, electrical contractors, of Burton-on-Trent, have in hand the following installation contracts:—

Crown Maltings, Burton-on-Trent.—Lighting and three-phase power installation for 40 motors with an aggregate H.P. of about 200.
Barnwell Castle, near Oundle.
Creaton Lodge, near Northampton.
Brockhall, near Weedon.
Cranford Hall, near Kettering.
Three-phase power installations for Worthington & Co., Ltd.; Truman, Hanbury, Buxton & Co., Ltd.; and Marston, Thompson & Evershed, Ltd.
New Secondary Schools, Kettering.
New Mining and Pottery Schools, Stoke-on-Trent.
Extension to North Staffordshire Infirmary, Stoke-on-Trent.

The firm have just completed the installation at the New Stoke Town Hall.

Consular Notes.—Russia.—The British Consul at Batoum reports that with a steady production averaging about 250 tons of copper per month, the Caucasus Copper Co. had a fairly profitable year in 1912. The directors of the company decided to proceed with measures for increasing the output of copper. Active steps were taken to carry out this work in 1912, and an additional large furnace was built at the smelting works; new roasters, a dust chamber and other improvements were introduced. A scheme for generating electric power by utilising the waste heat from the furnaces for raising steam was brought into existence, and a new power house equipped with machinery for developing up to 1,000 H.P. was added to the existing electrical plant. The concentration plant of the company was also extended during the year, and another unit to treat 500 tons of ore per diem is now being added to the installations under this head already in operation. It is expected that the new plant will be completed before very long, when the production will be almost doubled. This company's production in 1912 was about 40,000 tons of ore, and about 3,000 tons of copper.

The British Consul at Baku reports that the trade in internal combustion engines there is still progressing, the British makes of both oil and gas engines easily holding their own, but the heavier engines of the so-called Diesel type appear to be monopolised by Russian engineering works. British pumps, more especially transmission pumps, are still selling well. Wire ropes, belting and electric appliances, are shut out by the prohibitive rates of duty, but an American electric manufacturing company has recently secured a large proportion of the local electric business, by building works in Russia. Wire ropes, oil and gas motors and pumps are now practically the only articles in constant demand on the oilfields regarding which there is not a combination or understanding in the trade in question, to the detriment of the purchasing, oil-producing firms.

Later, in his report, the Consul states that the concession for electric trams granted to a Belgian company was not confirmed by the Viceroy of the Caucasus. It is now stated that this matter will shortly be referred back to the town authorities, the various alterations that are now required to be made in the contracts being specified. A refusal of the new terms must be first given to the Belgian company, and it was anticipated that an agreement would be come to and the question definitely settled early this year.

France.—The British Consul at Brest reports that the electric light and power works at Brest are not yet complete, but the town is now lighted by electricity, and work is sufficiently advanced to supply the town and suburbs of Brest with light and power. For the moment the company intend making provision for a radius of 15 miles round Brest, but they are ready to exploit the whole of North Finistère as soon as the demand is sufficient to warrant the enterprise.

Bosnia.—The British Consul at Sarajevo reports that electric light works are being erected at Livno. It is also proposed to obtain 26,000 H.P. from the River Rama for use partly on the Bugojno and Rama line, and partly in mines and industrial undertakings in the neighbourhood. The Aussig Chemico-Metallurgical Association has, it appears, obtained a concession for the erection of a power station at Jablanica, on the Narenta, to provide 21,000 H.P. for the working of a chemical factory, and 5,000 H.P. for the use of the Sarajevo and Gravosa Railway. A Dalmatian syndicate propose to utilise both the Narenta and the Rama below Jablanica for the production of about 9,000 H.P.

Hong Kong.—The American Consul at Hong Kong says that increased and increasing calls for lighting apparatus, fans and various special lamps are reported by Hong Kong importers. General progress is responsible for much of the demand, but the fact that Chinese merchants have found well-placed electric lights more effective and more economical than the lights previously used in their places of business is also responsible for the present increase. The demand for current has been such as to tax the capacity of local plants, while the extensive use of electric light has so directly affected the gas company that a little over two years ago it reduced the price of gas from $3.25 to $2.75 local currency per thousand feet (from 6s. to 5s. 6d. gold at exchange current at that date), and a reduction to $2.60 local currency has been made in the past six months. Further reductions are promised upon the completion of a new installation now being erected. There is also a strong demand for electric light installations ranging from 60 lights up to 30,000 lights, including complete engine and power equipment, dynamos, switchboards and wires and cables. The power desired is almost exclusively kerosene, crude oil or suction-gas motors of few and simple parts, which can be run by native engineers. A contract has recently been let for a considerable plant at Fatshan, a suburb of Canton, which has been secured by an English branch of a concern generally considered American. A small plant for Kongmun is being competed for. The demand for these small plants is growing to such an extent that various American and other foreign concerns are reorganising their South China agencies with a view to handling more business. The demand for electric equipment generally includes all kinds of lamps, lamp-stands and shades, particularly the new varieties of metal-filament lamps; various grades of insulated wires and cables; insulating blocks; and nearly all modern electric novelties. The use of electric irons, toasters, &c., so far is limited to foreign residents here. There is a growing trade in heaters for use in cool weather in Hong Kong and aboard ship. In fact, one of the strongest elements in the demand for all these goods at the present time is that for use aboard ship either in the way of temporary or supplementary installation or for introducing complete lighting systems in vessels overhauled here.

The demand for electric fans of all kinds is greatly on the increase. The demand for fans in Hong Kong is largely for ceiling fans of wide radius and several speeds. The Hong Kong power service is an alternating 100-volt current of 72 cycles per second. However, there has developed a considerable demand for desk fans for use abroad ship, and as a rule direct current is supplied for these. The current in Kowloon and various other points about Hong Kong is direct.

Dominion Republic.—The British Consul reports that a sum of 10,000 dollars has been set aside to bring into a state of efficiency the wireless apparatus already installed in Santo Domingo.

Canada.—The American Consul in Ontario reports that of the three hydro-electric power companies located on the Canadian side of the river at Niagara Falls, one has installed, during the past year, three generators of 15,000 H.P. each. Another will, during the present year or early in 1914, have in operation four additional generators of 13,000 H.P. each, while the third reports a large sum set apart for improvements to be inaugurated in the near future. Taking advantage of cheap factory sites, reliable power, and excellent transportation facilities, seven manufacturing industries of more or less importance have been established in this city during the past year, while a number of previously established factories have doubled their capacity during that time. The city industrial committee is negotiating with a number of manufacturing concerns who contemplate locating in Canada.

The Niagara, St. Catherine's and Toronto Railway (electric) is constructing a branch line connecting the city of St. Catherine's with Niagara-on-the-Lake at the mouth of the Niagara River. The line will be from 12 to 15 miles long, and will add another much-needed outlet for the products of this fertile fruit district.

The "Vita" Electric Heater.—Another simple electric heater which can be immersed in any liquid contained in an ordinary vessel, has been introduced by Messrs. Wagner and Geastley, Ltd., 28, Milton Street, E.C., who are the sole London agents. It can be connected to a lampholder with flex, and takes 440 watts, which suffices to boil a pint of water in five minutes. For many purposes such a device should prove exceedingly convenient

Bankruptcy Proceedings. — James Edwin Stott (trading as James E. Stott & Co.), electrician, 10, Wood Street, Byram Arcade, and 19, Westfield Road, Huddersfield, York.—An application was made at the County Court House, Queen Street, Huddersfield, on July 31st, for the discharge from bankruptcy of the above-named debtor. The Official Receiver pointed out that the receiving order was made against the debtor in March, 1898. At his public examination the debtor failed to produce certain books, which he had destroyed, but he (the Official Receiver) did not suggest that the destruction was done wilfully. Another matter which he thought might be brought before the Court, was that the debtor failed to give an account of how he lost £80 on a contract, but the sole cause of his failure was due to inexperience and youth. Mr. A. E. T. Hincheliffe, in supporting the application

for discharge, said the debtor was only 21 when he launched into business on his own account. He had had no experience in commercial life or financial affairs, but when he commenced business electricity was making rapid headway. He borrowed £50 from his mother, and put some money of his own into the concern. This was his undoing, but he would like to point out that there was no charge of fraud made against the debtor, and no doubt the failure had been brought about by inexperience and youth. It was quite true the debtor lost money on contracts, and he started his business as though he was going to set the Thames on fire. It was then found that he was not making any profits. Debtor had no intention of commencing business again, for a while at any rate, and it was 14 years since the receiving order was made. He ventured to say that if the debtor had made application before the Court for his discharge some 11 or 12 years ago, he would not have been applying for it that day. Debtor, in reply to his Honour, said he could not give any reason how he lost £80 on a certain contract, unless it was by underestimating. His Honour said it was an unfortunate failure, and the discharge would be suspended for three years.

W. R. WEDGE, electrical engineer, Albion Place, Northampton.—Receiving order made on creditor's petition, July 28th. First meeting, August 13th; public examination, October 13th; both at Northampton.

JOSEPH SWAINSON (J. Swainson & Co.), electrical contractor, 22, Booth Street, Manchester.—First meeting, August 14th; public examination, September 19th; both at Manchester.

Book Notices.—*Universal Directory of Railway Officials*, 1913. London: The Directory Publishing Co., Ltd. 10s.—This useful publication, the contents of which are compiled from official sources under the direction of Mr. S. R. Blundstone, editor of the *Railway Engineer*, contains information relating to Home railway and tramway undertakings, their *personnel*, mileage, motive power, &c. In many cases the names of municipal tramway committeemen are included. Foreign and Colonial systems have also a large amount of space devoted to them. The indexes are both geographical (as to systems) and personal (as to directors and officials).

"Handbook for Wireless Telegraph Operators, working installations licensed by H. M. Postmaster-General." London: Eyre and Spottiswoode, Ltd. Price 3d.

City and Guilds of London Institute Department of Technology. "Programme for the Session 1913-14." London: John Murray. Price 9d. net.

Dissolutions and Liquidations.—H. A. HARVEY AND CO., LTD., mechanical engineers and contractors, Norfolk House, Laurence Pountney Hill, E.C.—At the London Bankruptcy Court, on July 30th, the statutory first meetings were held of the creditors and shareholders of this company. Mr. H. E. Burgess, Official Receiver, reported that the company was promoted less than two years ago, with a capital of £50,000, to take over a business which had been carried on by Messrs. Harvey and Lee, under the style of H. A. Harvey & Co., for one year previously. The company paid about £7,000 in shares for the assets of the business, and took over liabilities to the amount of £1,000. The business of the company was chiefly that of exploiting patents and forming companies to take them over. They had spent a good deal of money, and there had been a loss on the trading throughout. In November, 1911, the directors promoted the Harvey Electrochemical Co., to take over the businesses of the Harvey Exploitations Syndicate and the Metal Depositing Syndicates. At a general meeting, held on November 4th, 1912, a balance-sheet was produced, the figures of which could not be borne out by facts. It returned 23,740 shares of 1s. each in a new subsidiary company as being worth £23,740, and in that way a profit of £16,786 was shown, but it could not be justified, because the company had in reality made a loss on the year's trading. On the strength of that balance-sheet further moneys were subscribed for the company's shares which would not have been forthcoming had the true facts been disclosed. The result of the company's trading was that they were now indebted to the extent of £4,800 to debenture-holders, and owed £3,500 to unsecured creditors; the assets were only valued at £4,090, which was not sufficient to meet the claims of the preferential creditors and the debenture-holders. Consequently there could be no payment to the unsecured creditors or the shareholders. The account with the latter showed a deficiency of £27,856. Mr. Wm. A. Henderson, chartered accountant, and the Official Receiver were respectively nominated for the post of liquidator, and the appointment will be decided in due course by the Registrar. The following are the principal unsecured creditors:—

Buck & Hickman	£87	Potter, F. W., & Co., Ltd. ..	£127
General Electric Co.	23	Siemens Bros. Dynamo Co. ..	220
Phœnix Motor Co.	160	Tighman's Patent Sand Blast	47
Phœnix Dynamo Co.	252	Victoria Dynamo Co.	45

NATIONAL TELEPHONE CO., LTD. — Creditors must send particulars of their debts, &c., to the liquidator, Mr. George Franklin, 22, Broad St. Avenue, E.C., by August 25th.

HEBBURN BOILER CO., LTD.—A meeting is to be held at 18, Market Street, Newcastle-on-Tyne, on September 11th, to hear an account of the winding-up from the liquidator, Mr. J. Taylor.

With reference to the notice which appeared on page 1022 of our issue of June 20th respecting H. Barder & Co., Johannesburg, Mr. A. Solomon, writing from Johannesburg under date July 14th, asks us to state that Mr. Barder has retired from the firm, and the business is now carried on under the style of the RAND ELECTRICAL CO., who take over all liabilities, stock and assets completely, Mr. Solomon being now in sole control. All communications for this firm in future are to be addressed to Corner of Loveday and Anderson Streets, or Post Office, Box 2712. Cables, "Reco, Johannesburg, S.A." Particulars of specialities are invited from manufacturers and wholesale merchants.

MEXICAN FUEL AND POWER CO., LTD.—This company is winding up voluntarily, with the Hon. R. C. F. Chichester, Pinner's Hall, E.C., as liquidator. A meeting of creditors is called for August 11th.

LONDON AND PARIS MAGNETO CO., magneto specialists, 154 and 156, Great Portland Street, London.—Messrs. L. Vogler and H. E. Kottmann have dissolved partnership. Mr. Vogler attends to debts and continues the business under the same name.

For Sale.—The Brighouse Corporation Sewerage Committee is offering for disposal electrical and other plant, of which particulars are given in our advertisement pages to-day.

The Holidays.—The works of MESSRS. S. BILL & CO., LTD., Aston, Birmingham, are closed until Monday next, 11th inst. The offices are open.

Private Arrangements.—GEORGE DIGGINS (trading as George Diggins & Co.), 75, Beak Street, London, W., electrical engineer, &c.—The creditors interested herein were called together last week, when a statement of affairs was presented, showing the position as at July 30th. This disclosed liabilities of £300. The assets were estimated to realise £415 net, or a surplus of £115. The debtor started in business nine years ago at Kensington, in partnership. About six years ago the partnership was dissolved, and in 1909 the debtor started at Beak Street, with a capital of £20. Owing to threatening creditors, the debtor had executed a deed of assignment. The debtor made an offer of 20s. in the £ at three, six, nine and 12 months, secured by the deed. It was resolved that the offer be accepted, secured by the composition deed, and that a committee of the three largest creditors should be appointed.

Catalogues and Lists.—ADNIL ELECTRIC CO., LTD., Artillery Lane, London, E.C.—Eight-page illustrated pamphlet, giving particulars and prices of electric desk and bracket fans. Further fan lists are printing.

MESSRS. KRUPKA & JACOBY, Westminster, S.W.—Illustrated and priced leaflets relating to Holophane reflectors and metallic-filament lamp fittings.

THE STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, London, E.C.—Pamphlet No. 1,742, containing a fully-illustrated description of their automatic coal crusher and sampler.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., inform us that they will shortly be revising and extending their "Wotan" Battery Lamp List, but in the meantime they invite special inquiries addressed to the Battery Lamp Department, at Tyssen Street, Dalston, N.E. "Wotan" battery lamps (drawn wire) are manufactured for voltages from 1·3 to 18 from ¼ to 50 C.P.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Booklet No. 17 contains description, with neatly executed illustrations, of their Pulsynetic picture indicators for use in cinematograph theatres, so that whether you are in the lounge, the café, or the entrance hall you can tell the number of the picture that is being shown. Prices are stated. We have also received from the firm a framed picture (in colour), entitled "Flood Tide—Port of Liverpool," showing the new Dock offices and the Royal Liver Building, also large vessels, for which they have supplied electric bells and telephones and electric clocks.

MESSRS. BAXENDALE & CO., LTD., Miller Street, Manchester.—Eight-page List, No. 3,177, containing illustrated information and prices respecting electric fans—table, lampholder, battery, automatic air, exhaust, ceiling and porthole types, also speed regulators for same.

Trade Announcements.—Owing to increased business, MESSRS. HARRY WITTASEN & CO. have removed to more extensive and convenient premises in 24, Thavies Inn, London, where they are showing their latest designs in electrical glassware.

MESSRS. MANN, EGERTON & CO., LTD., have removed the electrical department of their business from 5, Bank Plain, to 21 and 23, King Street, Norwich.

San Francisco Exhibition.—It is understood that neither Great Britain nor Germany will take part officially in the Panama Exhibition at San Francisco, but that, of course, individual firms will be at liberty to do as they please.

LIGHTING and POWER NOTES.

Accrington.—The electrical engineer has been instructed to prepare plans and estimates for an additional water filter to keep pace with the requirements of the boilers at the electricity works; and also to submit an estimate of the sum required for extensions of mains and service cables, and the provision of extra high-tension switchgear and transformers for the ensuing three years, with a view to application being made for borrowing powers.

During the quarter ended June 30th, the Corporation sold 1,183,189 units as against 982,799 units for the corresponding period of last year, or an increase of 200,390.

Aberdeen.—The authorities of Banchery, Aboyne and Ballater are considering a scheme for lighting, by electricity, their respective burghs; the current would be supplied by the Aberdeen Corporation, and sub-stations would be erected at the places mentioned.

Atherton.—The D.C. has made arrangements for the provision of a new electrical transforming station in the centre of the town, and simultaneously with the erection and equipment of the building, the street mains will be sectionalised and duplicated.

Aylesbury.—New Generating Station.—The U.D.C. has decided to proceed with an E.L. scheme, using Diesel oil-engine sets, and to erect a generating station in the centre of the town The estimated cost, with a dust destructor, is £31,387.

Barnsley.—Annual Accounts.—The returns for the last year's working of the electricity department show a total revenue of £15,388, and expenditure in production, management, &c., amounting to £8,352, leaving a gross balance of £7,036. After payment of interest, sinking fund, &c., a net balance of £581 remained; £500 was allocated in relief of the rates, making a total of over £7,000 contributed in this way from the department's profits. The units sold during the year were 2,055,570. The year's profits were on a smaller scale than in previous years, due to increased coal prices and financial charges, and reduced charges for lighting; fortunately, the new turbine and boiler plant helped in the matter of coal, as the following figures show:—

Year.	Units generated.	Coal used, tons.	Coal cost.	Average price, p.t.	lb. per unit generated.
1912 ...	2,021,216	7,680	£2,399	6/3	8·58
1913 ...	2,435,798	6,809	£3,004	8/10	6·27

The whole of the public lamps are electrically lighted, and during the year metallic clusters were substituted for the arc lamps formerly used.

Barton-on-Humber. — Electricity Supply Commenced.—The ceremony of inaugurating the electricity supply for the town, provided by a local syndicate, was at the end of last week performed by the chairman of the Urban Council, Mr. W. A. Stow. The syndicate, whose resident engineer is Mr. Gooch, late of Barrow-in-Furness, has been given the contract for public lighting for 12 years.

Bedworth.—Street Lighting.—The P.C. has signed an agreement with the Leicestershire and Warwickshire Power Co. for public lighting from August 14th.

Bradford.—Street Lighting.—A special Sub-Committee of the Finance and General Purposes Committee, after the matter had been considered by the electrical and gas engineers, has recommended the Council to light the Thornbury and Tyersal districts by means of electricity, and to erect approximately 84 electric lamps in streets in which electricity mains are already laid, the lighting to be charged for at the same rate as in the case of Tong Street, Dudley Hill. The annual charge is to be £4 per 200-watt lantern, and certain gas lamps in side streets are to be converted into electrical lamps at an annual inclusive cost of £2 12s. 6d. per lamp.

The electrical engineer has also been authorised to carry out the necessary works for lighting by electricity, at an annual inclusive charge of £7 per 500-watt lantern, of six main road crossings.

The chairman and deputy-chairman of the Electricity Committee, together with the electrical engineer (Mr. T. Roles) have been appointed to visit certain generating stations at Berlin and other cities on the Continent for the purpose of inspecting turbo-generating plant.

A Financial Report.—In a report which has been prepared by the Bradford city treasurer (Mr. F. Ogden Whiteley) for the Electricity Committee, figures are given which show that the total amount expended on the electricity works and plant has been £932,000, which includes £12,000 paid directly from revenue, and £55,000 from renewals account. Out of this huge amount the present debt is only £502,000, representing 54 per cent. on the full sum. The expenditure on the Bolton Road works, which were erected in 1899, was £41,000, and all but 16 per cent. of this has been paid off, whilst in connection with the cost of the machinery no less than 90 per cent. of the outlay has been extinguished. At the Valley Road works over 50 per cent. of the cost of the land has been paid off, and there is only an outstanding debt of £64,000 on No. 2 Works—38 per cent. of the expenditure. No. 3 Works have only been opened comparatively recently, but one-third of the money spent in building the place and fitting it with machinery has been paid off. Last year the income increased by, practically, £10,000, and the amount contributed to reserve and renewals account to date is £79,000, of which £55,000 has been spent, leaving a balance of £24,000.

At the T.C. meeting when the proposal to borrow £86,250 for new plant was considered, mention was made of the suggested expenditure of £500,000 on new works to replace those at Valley Road, and a question was asked as to whether it would not be better to go on straight away with that work and spend the £86,000 upon that scheme, but it was pointed out that the Valley Road works would always be retained as a transforming and distributing station, and it would pay the Corporation to spend £86,000 on the Valley Road works, even if they were only going to remain there for 10 years, rather than spend £500,000 on new works and pay £40,000 a year in interest and sinking fund.

Bridlington.—The L.G.B. has advised the Electricity Committee to obtain Parliamentary powers to supply electricity outside the borough.

Brighouse.—Electricity at Sewage Works.—The T.C. has decided to substitute electric power for steam power at the sewage disposal works, and to obtain a supply of electric current from the Yorks. Electric Power Co., in respect of which an agreement is to be entered into which will be in force until 1927, instead of 1920, as previously suggested.

Bristol.—A proposal by Mr. Gane, recently adopted by the T.C., urges on the Electricity and other committees the advisability of substituting electricity for gas in buildings owned or controlled by the Corporation.

Canada.—The report for the first fiscal year of the Winnipeg municipal plant, ending April 30th, 1913, shows a deficit of $53,024 88 for the 12 months. It is pointed out, however, that the plant commenced actual earning only last September, and that other delays occurred in connecting up offered business. The total operating earnings of the power department for the fiscal year amounted to $475,509.57. Total charges in the same year, including interest on stock and debentures, sinking fund, and an allowance of $52,862 for depreciation, amounted to $529,442.60. The revenue deficit for the year is, therefore, $53,024.88.—*Electrical World.*

Caton.—Street Lighting.—The installation of the electric light at Caton has already been commenced, and consumers connected up. If funds are available, electricity will be utilised for public lighting in place of the present oil lamps.

Chelmsford.—The T.C. has referred back for further consideration a recommendation by the Lighting Committee to the effect that at present it would not be advisable for the Corporation to take steps to purchase the undertaking of the Electric Supply Corporation, Ltd.

Cheltenham.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £2,000 for mains extensions. The cables are to be extended so as to supply current to the Borough Laundry in the Swindon Road.

Chorley.—Prov. Order.—At a meeting of the T.C. on July 31st, it was reported that the Lancashire Electric Power Co. had written intimating that it was its intention to apply to the B. of T. for a prov. order to authorise the company to supply electricity within the borough. The matter was referred to a sub-committee.

Continental Notes.—Germany.—In connection with the plant which is being put down to utilise the water-power of the River Weser at Dorverden, Messrs. Amme, Gieseike & Konegen, of Brunswick, have secured an order for a number of turbines, the outside diameter of which will be no less than 15¾ ft.—they being described as the largest turbines so far built in Germany.

Portugal.—A scheme is under consideration for the establishment of a central generating station for the supply of electrical energy for lighting and power purposes in the Guarda and Belmonte districts of Portugal.

Corsham.—Mr. Edwards, of Bristol, has informed the local authority that he intends applying for a prov. order for electric supply at Corsham. The P.C., which has had the matter brought to its notice, is in favour of a scheme being carried out.

Dover.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £350 for a period of ten years for the provision of two new superheaters at the electricity station.

Ealing.—The Council has agreed to supply Mr. A. F. Berry with electricity for experimental water heating, at ½d. per unit.

Edinburgh.—At a meeting of the T.C., Councillor Stevenson moved that the surplus on the electric lighting accounts, amounting to £2,169, be applied towards the reduction of the capital money borrowed for electricity purposes. He pointed out that by the increased use of metal filament lamps, the sales for lighting remained stationary. A large scheme of extension was absolutely necessary, and that would involve additional expenditure. Councillor Harrison, moved as an amendment, that the surplus be applied towards the rates, on the ground that the treasurer needed the money. This was seconded, and on a vote, the amendment was carried by 28 votes to 16.

Exeter.—The Governors of the Royal Devon and Exeter Hospital have adopted a scheme for improving the electricity and heating departments at the hospital at a cost of £1,723, under which the entire buildings are to be connected with the municipal supply of electricity.

Fife.—Through the breakdown of a turbine at the Fife Electric Power Co.'s generating station at Townhill, the greater portion of the tramway service in Fife was brought to a standstill on Monday.

Finchley.—The U.D.C. has approved a report of the Electricity Committee which stated that applications had been received from a number of householders and others for a supply of electricity to premises just outside the Finchley area, and in order to avoid any possible delay entailed by approaching the Friern Barnet Council on each set of applications, it had been suggested that the Council might agree (subject to the consent of the B. of T. and the other necessary parties to each such set of

applications) to the Finchley Council supplying any premises within a defined area where the occupiers signifies their desire for such supply. As a result of correspondence with the Friern Barnet Council, a plan of the suggested area had been prepared for the consideration of the latter authority.

Gillingham (Kent).—The T.C. has authorised the electrical engineer to purchase sets of electric cookers for hiring-out purposes.

Glasgow.—Annual Accounts.—The electricity department returns for the year ended May 31st last show that the gross revenue amounted to £345,749, against £319,932 in the previous year, and the working expenditure to £170,640, against £138,515—a surplus of £175,109, compared with £181,417. Out of this the Committee had to meet the interest on loans, sinking fund, &c., which amounted to £117,282, compared with £115,351. This left a balance of £57,827 on the year's working—£66,066 last year—from which there was deducted for depreciation, &c., £50,307, compared with £55,315. This left a surplus on the year's operations of £7,520, against £10,751 in 1911-12; this has been transferred to the credit of the several reserve funds, which now amount to £60,372. The increase of income from all sources amounted to £25,817; on the other hand, the working expenses increased £32,125, principally due, apart from the larger output, to the higher price paid for coal, and also to an increase in respect of rates, taxes and assessments. The depreciation written off the capital account since the inception of the undertakings is as follows: Glasgow, £545,987; Govan, £2,301; Partick, nil. Total, £548,288. Notwithstanding that contracts have been entered into for the supply of coal at an estimated increased expenditure of £5,500 as compared with the year just closed, the Committee recommended that for private lighting purposes the price of current remain at 3½d. per unit, but that the quantity be reduced from an equivalent consumed per annum averaging 650 hours to 600 hours, and that for heating purposes—250 to 500-volt supply—the rate for any quantity of current, equivalent to 1,000 hours per annum of the maximum demand, be reduced from 1½d. to ¾d. per unit, and that the special rate to domestic consumers, for current used for cooking, heating, or other domestic uses, over 800 hours use per annum of the maximum demand for lighting, where energy for lighting and power purposes is taken through the same meter, be ¾d. per unit instead of 1d. The quantity of electricity sold to private consumers during the past year in the Glasgow, Govan, and Partick areas was 60,133,955 units, of which 18,482,899 units were for lighting and 41,651,056 for power purposes, the revenues being £186,018 and £136,058 respectively, while the total number of consumers was 27,848. The total number of motors in use was 8,805, with a total H.P. of 59,144. In connection with the electric lighting of public streets, the Committee has now practically completed the replacement of old type lamps by flame arc lamps in the old Glasgow area. This has so greatly improved the illumination of the streets, that a further order for flame arc lamps has been placed, principally for Main Street, Gorbals. The total of lamps or other current-consuming apparatus connected to the mains was 82,016 KW., and the maximum load occurred on December 18th last, when it was 33,639 KW.

At a recent T.C. meeting, discussion took place over a proposal to send the electrical engineer and a member of the Electricity Committee to the United States for the purpose of getting information as to the largest installations of plant in operation there. Bailie Smith pointed out that the Corporation had purchased a large piece of ground for the purpose of erecting a new generating station, and as their present stations were equal to anything in Great Britain, they wished to see what could be learned by a visit to the largest and best stations in the world, particularly at Chicago. The sum involved in the proposed station would be about a quarter of a million sterling. No consulting engineer would be employed. It was decided, after a long discussion, to send the deputation, which will consist, probably, of the convener (Bailie Smith) and the engineer, Mr. W. W. Lackie.

Gloucester.—Annual Accounts.—The last year's working of the electricity department shows a deficit of £106 after meeting all charges. The revenue increased by £1,100, and the gross profit, £6,747, was £500 more than in the previous year, but extra capital charges on plant, which had not been fully used during the year neutralised this. The output for all purposes was 1,718,000 units.

Great Harwood (Lancs.).—The Proposed Electricity Supply.—It is reported that there is every indication that the local electricity question will soon be settled, and that it is not unlikely that current will be taken from Accrington in bulk. Last week a local sub-committee had a conference with an Accrington Corporation committee, when terms were discussed.

Halesowen.—The Midland Electric Corporation for Power Distribution, Ltd., has applied to the B. of T. for consent to supply current in bulk to the Halesowen Lighting and Traction Co., Ltd. The latter company has informed the R.D.C. that it is about to lay cables for the supply of current in the Council's area under the prov. order obtained.

Havant.—Prov. Order.—The U.D.C. has been informed that a prov. order for electric light at Havant and Emsworth is being applied for by Messrs. Biscoe-Smith & Blagg.

Haworth (near Keighley).—Prov. Order.—The Council proposes to apply at the end of the year for a prov. order to enable it to supply electrical energy.

Henley-on-Thames.—Prov. Order.—The T.C. on July 30th received notice of the intention of Messrs. Foote and Milne, of London, to apply for a prov. order for electricity supply.

Hove.—A Joint Committee, appointed by the T.C. to consider what steps shall be taken respecting the powers obtained to purchase the undertaking of the E.L. Co., has intimated that, before coming to any conclusion, it will be willing to receive, and give careful consideration to, any authorised proposals or suggestions which may be forwarded by persons interested in the matter, such as the taking over and working of the undertaking. Opinions on the question of municipal trading in the borough are divided.

Japan.—Now that the amalgamation scheme between the Nippon Electric Light Co. and the Tokio Electric Light Co. has been dropped, a price-cutting war would appear to have set in with regard to electricity supply in the Japanese capital, three of the companies having just announced a reduction in their charges.

Kingstown.—Considerable discussion has been aroused here by the action of Messrs. Field and Mooney, M.P.'s, in blocking the Parliamentary proceedings to give Kingstown electric light through the medium of a private company which, it is stated, has already spent some £2,000 in preliminary operations. The company in question, when starting operations, made offers to the neighbouring Urban Districts of Dalkey and Blackrock. The Blackrock Council, then negotiating with Pembroke Urban District Council for electric light, did not accept. The Dalkey authorities accepted, but at a later period the agreement fell through owing to the question of overhead or underground wires becoming a point at issue. The company's operations, therefore, became restricted to Kingstown. The blocking of the proceedings comes as an unpleasant shock to the Kingstown Council, which had approved the scheme, and to those interested in the venture.

Limerick.—Last week Mr. A. D. Price, of the L.G.B., held an inquiry into an application of the Corporation for a loan of £9,500, to extend the electrical lighting plant. It was stated that the concern had been working at a loss, £2,000 having been voted last year from the rates to meet the deficit. It was calculated, however, that there would be an increased revenue this year.

Llandudno.—The Electricity Committee has had under consideration a financial statement prepared by the accountant on the result of the year's working of the electricity undertaking for the 12 months ending March 31st, 1913, and it was resolved that the Council be recommended to make a price reduction to consumers as follows:—Maximum demand rate, from 7d. and 2d. to 6d. and 2d.; flat rate, from 4½d. to 4¼d. per unit.

London.—Port Crane Equipment.—As recently mentioned in these notes the Port of London Authority is to install at the Albert Dock 43 electric luffing cranes, each of 60 ft. radius, and of a lifting capacity of 30 cwt. at ordinary speed, with gear to admit of lifting 3 tons at a slower speed. We understand from a usually well-informed correspondent that the contract for the whole of these 43 cranes has been provisionally placed with Messrs. Babcock & Wilcox, Ltd. The cranes will be erected on the north side of the Albert Dock; a total expenditure of £104,000 has recently been authorised for the provision of these new cranes.

Hammersmith.—Street Lighting.—The Works Committee proposes, subject to the concurrence of the Electricity Committee to the terms suggested, to convert 50 side street gas lamps for electric lighting at an estimated cost of £300. The amount proposed to be paid to the Electricity Committee for current, maintenance, &c., is at the reduced rate of £2 7s. per lamp per annum, as against the present payment of £2 14s. for electricity (and £2 6s. 10d. for gas). The question of reducing the charge for the existing electric lamps in side streets (£2 14s., plus 7s. repayment of capital charge with interest) is under consideration.

Lambeth.—The B. of G. has accepted an offer of the South London Electric Supply Corporation, to provide at the infirmary, free of cost to the guardians, a special installation for power supply, so that the lighting supply may be quite distinct from the power supply, and thus prevent the present objectionable fluctuation in the lighting.

City Street Lighting.—The City Engineer's report on street lighting matters shows that there were 402 arc lamps in regular use and 21 experimental arc lamps and 45 metallic-filament lamps in addition, a total of 468 electric lamps in all. The experimental electric lighting consists of 3,000 and 4,000-C.P. arcs and 75-C.P. metal lamps; it is hoped that by next winter the new lighting arrangements under which the city will be illuminated in about equal proportions by electricity and gas, will be nearly complete.

Luton.—The B. of T. has approved the Council's proposal to give supplies of energy at extra-high pressure.

Lytham.—The question of electric lighting has proceeded a step further. The D.C. has had the matter under consideration, and a communication is understood to have been sent to St. Anne's Council, which owns its own electricity works, regarding a supply in bulk. Since the B. of T. enquiry into Lytham's application for power to have control over the electric lighting of the town, the question has been carefully discussed.

Manchester.—For the quarter ended June 30th, the distribution of electricity for lighting is 12½ per cent. larger than for the corresponding period of last year. The figures as to the use of electricity for power purposes are 29¼ per cent. ahead of anything recorded before in Manchester.

Nuneaton.—Correction.—In our issue of July 25th the new plant recently started up at the Council's electricity works was referred to as "of B.T.H. make"; we are now informed by Messrs. Siemens Bros. Dynamo Works, that the turbo-generator in question was supplied by them.

Rothesay.—Mount Stuart, Bute, the residence of the Marquis of Bute, is to be completely fitted with electric lighting, heating and cooking, and also a ventilation system worked by electricity. The contract has been secured by a Paisley firm, and the work will be completed in two years. In all there are 2,500 lamps. The number of bedrooms to be fitted is 165.

Rushden.—The E.L. Co. is making preparations for a supply of current, and generating plant is being installed at the works.

Salford.—Sanction is being sought to the borrowing of £6,935, the amount deducted by the L.G.B. from the sum applied for in respect of rotary converter plant.

South Africa.—The new steam turbo-alternator at the Cape Town electric light works in Dock Road was inspected recently by members of the Corporation. This turbine-alternator, which is of 2,000-KW. capacity, was supplied by the B.T.H. Co., and the condensing plant manufactured by Messrs. Richardsons and Westgarth. A 1,000-KW. Peebles motor-converter has also been installed. The plant at the inauguration of the power station in 1903 consisted of two 750-KW., one 300-KW. and one 150-KW. D.C. steam generators; a total of 1,950 KW. In 1909, when the supply to the Government railways and harbours was undertaken, two 400-KW. A.C. steam-driven generators were installed, making the total capacity of the plant 2,750 KW. Subsequently, owing to the supply area being extended to Sea Point and the southern suburbs, and to the general increase of consumers, it was decided to install the further additional plant.

Spilsby.—Messrs. Crompton & Co., of London, have informed the R.D.C. that they intend applying for a prov. order for electric light at Ingoldmells, Winthorpe, Burgh, Croft, Wainfleet and Friskney.

Walmer.—At a meeting of the U.D.C. on July 31st, a letter was received from Messrs. Horace Boot & Partners suggesting that the Council should take advice as to the advisability of taking over a prov. order for electric light, and obtaining current at a low rate from one of the adjoining collieries, and so place at the disposal of the ratepayers a cheap supply of electricity. A member asked when the existing syndicate would be supplying current, and the chairman replied that the matter was proceeding satisfactorily, and he thought that before long there would be something definite to put before the Council. Those interested in the supply were doing all they could to further it.

Warrington.—Electricity Works Fire.—An outbreak of fire occurred at the Corporation electricity works in the early hours of Sunday morning. The fire brigade succeeded in preventing the flames from spreading from the boiler house to the coal elevator, and the fire was not sufficiently serious to cause interference with the electricity supply of the borough.

Watford.—Street Lighting.—The electrical engineer has been instructed to report upon the advisability of lighting Queen Street by centrally suspended lamps.

West Bromwich.—The T.C. has decided to extend the mains at a cost of £800, in order to supply current to the works of Stone Bros., Ltd. A supply is also to be afforded to the premises of D. Gibbons & Co., Hilltop. The former supply is to be by overhead cables.

Willesden.—L.G.B. Inquiry.—An inquiry, presided over by Mr. T. C. Ekin, was held on July 31st last in connection with the Council's application to borrow £4,667 for the erection and equipment of a sub-station at Acton Lane.

Wimbledon.—Loan Sanction.—The sanction of the L.G.B. has been received to the borrowing of the following amounts required in connection with the electricity undertaking:—House services, £1,000; transformers, £800; meters, £1,850; high tension mains, £500; low tension mains, £1,500. The following expenditure will also probably be incurred between now and March, 1915, and borrowing powers are to be applied for:—Mains and house services, £8,560; meters, £850.

Wrexham.—The T.C. has confirmed a proposal of the electricity committee recommending the purchase of three electric ovens, two at a cost of £8 each and one at a cost not exceeding £5, the same to be lent free of charge to consumers during trial.

The electrical engineer has been authorised to negotiate with the Governors of the Boys' Home to be erected in Rhosnessney Road as to terms for a supply of electricity, and with the Wrexham Co-partnership Tenants, Ltd., as to a supply to houses to be erected outside the borough.

Yeovil.—Electric Sewage Pumping.—The T.C. has adopted a scheme for utilising electricity for power at the sewage disposal works, and to reserve gas for use in case of a breakdown. The scheme will entail an expenditure of £960.

York.—Prov. Order.—The T.C. has decided to hold a special meeting on September 1st to consider the advisability of applying to the B. of T. for a prov. order for electricity within the areas of the Great Ouseburn, the Bishopthorpe, the Escrick, the Tadcaster, the Flaxton, and the Easingwold R.D.C.'s.

TRAMWAY and RAILWAY NOTES.

Argentina.—The electrification of the Santa Fé tramways is being rapidly pushed ahead, and it is expected that the first section will be ready early in 1914.—*Review of the River Plate.*

Barking.—Arrangements have been completed with the East Ham T.C. for supplies of current for traction purposes.

Belfast.—At the monthly meeting of the Corporation the closing down of the Ravenhill Road extension, which was being run at a loss of £2,000 per annum, was discussed, and was finally decided upon. The management of the tramway system, it appeared, were against the extension when it was originally mooted, but the Corporation went on with it, with the foregoing results.

Blaydon.—A deputation from the Blaydon governing authorities has waited upon the Newcastle-on-Tyne Tramways Committee, requesting it to secure the necessary powers for running a railless trolley system to Scotswood and Blaydon.

Bolton.—The borough engineer has reported to the Tramways Committee upon the reconstruction of track on the Manchester Road, and has been instructed to arrange for an experimental length of 200 yards to be laid on wooden sleepers fixed transversely.

Brighton. — The Tramways Committee of the T.C. has decided to expend £5,000 on renewing the tramway track in London Road.

Chile.—According to the *Review of the River Plate*, the Senate is preparing a definite project for the electrification of the Santiago-Valparaiso Railway.

Colne.—The Finance Committee reported on July 31st that the costs incurred in connection with the promotion of the Colne Corporation Bill, 1913, for taking over the undertakings of the Colne and Trawden Light Railway Co., amounted to £595.

Continental Notes.—Italy.—An important scheme to utilise the water power of the River Tirson, on the Island of Sardinia, is at present under consideration. In summer the river often runs dry, while in the winter it becomes a torrent, which frequently threatens to flood the district through which it flows. It is proposed to construct a dam having a capacity of 330 million cb. metres, and thus flooding will be prevented and water power estimated at over 10,000 H.P. will be rendered available.

Dartford.—The Tramway Co. has applied for an extension of time for the construction of the electric tramways from Horns Cross to Swanscombe.

Dewsbury.—The Corporation and the National Electric Construction Co. are in negotiation with respect to suggested tramway developments to serve Shawcross, Hanging Heaton, Boothroyd and Dewsbury Moor. No details have yet been made public, but the Council hopes that if the new lines are adopted they may be self-supporting in 12 years' time. The lines will pass through the Market Place and join the system of the British Electric Traction (heavy woollen district), and afterwards branch off at Willans Road leading to Dewsbury Moor.

Dunfermline.—The T.C. is to consider a proposal by the Tramways Co. in regard to the extension of the line to Milesmark. By the Act of Parliament the company is bound to pay £100 per mile to the T.C. for the first three years and £125 thereafter. The company; however, represented that if it was to proceed with the Milesmark extension, it must have a reduction, and it suggested that the payment should be not more than £60 per mile for a period of seven years. The Council agreed to the proposed reduction, but fixed the period to which it applies at five years instead of seven.

Edinburgh.—The tramway strike, after lasting for 12 days, has been amicably settled as between the company and its employés.

Glasgow.—At its next meeting the T.C. is to consider a proposal by Councillor Shedden, that, as a means of solving the question of congestion on the streets, and of giving facilities towards the expansion of the city, the Corporation appoint a special committee to consider the feasibility of establishing a system of tube electric railways from east to west (say Shettleston to Clydebank), and from north to south (say Bishopbriggs to Rouken Glen).

Gloucester. — The working of the city tramways during the last financial year resulted in a loss of £3,700, or £1,400 more than in the preceding year.

Heston and Isleworth.—At the last meeting of the U.D.C. the Works Committee reported that the Tramway Co. had decided to repair their tracks in the district; also, to "slew" the line along Twickenham Road, on the condition that the Council agreed to suspend its powers to acquire the undertaking until 1930. The committee's recommendation to give effect to this arrangement was agreed to.

Holcombe Brook (Lancs.)—L. and Y. Electric Line.—The electrification of the Holcombe Brook branch line of the Lancs. and Yorkshire Railway has been completed, and the running, which was commenced last week, is reported to have been very successful so far.

Japan.—The Jobo Electric Tramway Co. is the name of a new company which has lately been formed in Tokio with a capital of £100,000 to construct and work an electric tramway from East to West on the north-western side of the city.

Leeds.—Alterations are to be made at the Harehills tramway terminus, which will do away with the "shunting station" which has previously caused so much delay. The estimated cost of the necessary alterations is £660.

The sub-Tramways and Electricity (Extensions) Committee has recommended the Council to make application for powers to carry out a number of tramway and railless trolley route extensions which were originally estimated to cost £191,000.

The general manager, Mr. J. B. Hamilton, has been given permission to render assistance to the Bristol Corporation in connection with the projected purchase of tramways in the city.

Leigh.—It is understood that the South Lancashire Tramways Co. is to be asked to construct tramways from Leigh through Astley, which is becoming an important coal-mining centre, to Boothstown, connecting with their present system there.

U.S.A.—What is described as being the first trolley motor-'bus service in the United States has lately been started in the town of Merrill, Wis. The line is about a mile long, and works in conjunction with the tramway system.

Salford.—The Tramways Committee is informing the L.C.C. that it cannot see its way to support the opposition to the terms of a clause proposed to be inserted in the Tramways and Improvements Bill now before Parliament giving the L.U. Tramway Co. running powers on certain lines now being acquired; but, in the event of an arbitration, it would be prepared to give evidence in support of the principle that when one authority is running cars on another authority's lines, the first-named authority should not be allowed to make a profit out of such running.

Southend-on-Sea.—On July 30th a new section of the local tramways was opened linking up Bournes Green with Southchurch; next spring the route will be continued to Thorpe Bay, at a total cost of £30,000. The track is laid on Jarrah wood sleepers.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—A decree accords to Don Landelino Zid a 30-year concession for the installation and working of a telephone network in the Coyle Department of the State of Santa Cruz.

Canada.—Edmonton, Alberta, will spend $1,000,000 on telephone extension work in 1913, the greater part of which will be cable work. The telephone lines in Alberta are all owned by the province and municipalities. The superintendent at Edmonton is Mr. W. R. Griffiths.

French Wireless Proposals.—The new scheme for the creation of an intercolonial wireless network drafted by M. Dalimier, on behalf of the Commission du Budget, contemplates the division of the commercial service into a long-distance and a local network. It authorises the Minister of Commerce, Posts, Telegraphs and Telephones to raise a sum of £631,800 for (1) experiments and trials of new instruments and systems of station organisation; (2) the construction and equipment of wireless stations, including accessory buildings for plants and staffs in the following places:—Eastern lines: Southern France, Tunis, Djibouti, Pondicherry, Saigon and Madagascar. African and South American lines: Southern France, Morocco, Saint Louis, Colomb Bechar, Timbuctoo and Bangui. Pacific lines: Southern France, Morocco, Saint Louis, Martinique, Marquisa Islands, Tahiti, Noumea, Saigon. North American line: Western France. Provision is to be made in each Finance Law for the disbursements involved. A technical committee is to be formed at the Ministry of Commerce to examine all questions related to the service. The Budget Commission, it is stated, has accepted all the stations indicated, excepting Colomb Bechar, which it regards as unnecessary.—*La Lumière Electrique.*

Germany.—It is announced that the agreement between the German Imperial Post Office and the Telefunken Co., which was foreshadowed in the Reichstag this spring, is now complete, and that the head station of the company is in direct connection with the Imperial telegraphic system. The station is at Nauen, 10 miles from Berlin. The Reichstag has already voted funds for the construction of stations at Windhoek (German South-West Africa) and at Togo (German Gold Coast), and these stations will shortly be in working order, while a third station in German East Africa is to be ready by the end of next year. By this means the German Government hopes to be entirely independent of cables.—*Standard.*

Imperial Wireless System.—Last week the new agreement between Marconi's Wireless Telegraph Co., Ltd., and the Postmaster-General for the construction of a chain of Imperial wireless stations was made public. It stated that the execution of the work by the State had been considered, but no existing department could undertake either to erect or to work the stations, and the formation of a special staff for the purpose would involve delay, while, when constituted, the staff would have no claim on the assistance of any company experienced in long-distance wireless telegraphy on a commercial scale. The Treasury, therefore, preferred to place the work of construction in the hands of a contracting company. The consideration of urgency was of prime importance, and had been intensified by the serious delay already incurred. Great importance was attached to the principle of competition by public tender or between contractors on an approved list, when it was possible, but in view of the report of Lord Parker's Committee, to the effect that the Marconi system was the only one capable with certainty of fulfilling the requirements, and as the position had not been materially modified since that report was issued, the Treasury authorised the reopening of negotiations with that company.

There was no doubt that the price of materials had risen considerably since the date of the company's original tender; the new agreement, therefore, provided for the readjustment of the standard price of £60,000 per station, strictly in accordance with market reports as ascertained and certified by the Engineer-in-Chief of the Post Office, up to the date of approval of the new agreement by the House of Commons. No further change in the standard price would be made. A general specification was now scheduled to the agreement, and variations from the specification would involve variations in the price per station. In view of the present conditions of the money market, it was provided that interest at 2 per cent. would be paid on each third part of the purchase money; on the other hand the company agreed that the Postmaster-General should have the right to use the stations for experimental working before completion; that he might cancel the agreement in respect of the stations in India, South Africa and Singapore at any time before their completion, subject to payment for the actual work done, and subject to the Marconi Co. being given the opportunity to tender for a continuous wave system on equal terms with its competitors; and that the royalty payment should be made in respect of each station, independently of the rest, so that the royalty would be modified if Marconi patents were dispensed with at any station, provided that the Government agreed to the inclusion of the East African station (where the company's inventions were not patented) for royalty on the same terms as the other stations. This concession in respect of the East African station was only made when the company consented to sub-divide the royalty payments, as follows: 4 per cent. for patents for internal transmitting apparatus, and 2 per cent. each in respect of external transmitting, and internal and external receiving, apparatus—enabling a proportionate reduction of royalty to be made on discontinuing the use of any one of these sections. The retention of a Marconi patent at one station does not now affect the royalty on the other stations at all; and where it is retained, the only royalty payable is in respect of the one section to which it belongs.

The provision that the Postmaster-General should consult the company before introducing patents or apparatus other than theirs has been dropped, and the power of the company to inspect non-Marconi installations at stations other than those erected under the agreement has been modified to the satisfaction of the Treasury. The company no longer will possess the exclusive right to erect long-distance stations for the Government during the five years from the date of the agreement. A time-limit for the construction of the work is now provided for, with a penalty of £150 for each month's delay. The speed of automatic working to be demonstrated is raised from 50 to 75 words per minute, except in the presence of temporary atmospheric disturbances, and provision is made that if the Government is using a non-Marconi patent at a station on terms arranged with its owners, the Marconi Co. may not, by purchasing it from those owners, convert it into a Marconi patent within the meaning of the agreement. The agreement is not to be binding unless and until approved by a resolution of the House of Commons before the end of August.

Reports by the Engineer-in-Chief of the Post Office and the Inspector of Wireless Telegraphy indicate that, in their opinion, it is not desirable to invite tenders from either the Goldschmidt or the Poulsen companies at present.

Further questions were asked respecting the Marconi patents, in the House of Commons on Monday. In regard to the validity and registration of the patents in various countries, Mr. Samuel repeated that the most careful inquiries would be made before any royalty was paid, but he had not yet decided on the form of inquiry. This drew from a member an expression of surprise that the Postmaster-General should have been negotiating for two years for the use of oversea patents without consulting a competent expert on the registration question; but Mr. Samuel replied that the matter was of importance to the company, as, if there were no patent, there would be no royalty. In regard to the station in British East Africa, Mr. Samuel said that the royalty would be divisible in the same way as for the other stations. He was unable to give any reliable estimate of the amount involved, as it would depend on the quantity of traffic and the rates chargeable to the public, which had not yet been fixed.

Italy.—Parliament has authorised the Minister of Posts and Telegraphs to spend a sum of £2,160,000 in the construction of overhead and underground telephone lines.

Japan.—In connection with the extension of the telephone service in Japan within the present year, it is announced that the funds at the disposal of the authorities are so limited that the number of new installations will not exceed 20,000. In the smaller towns new telephone installations will, it is believed, be suspended for the time being.

Post Office Employés.—According to the *Times*, a ballot of the United Kingdom Postal Clerks' Association (membership 9,000), and the Postal Telegraph Clerks' Association (membership 11,500), has resulted in a joint majority of over 10,000 in favour of the amalgamation of the two unions.

Regulation of Wireless Communication in Germany.—The German Imperial Post Office and the Home Office authorities have jointly issued new regulations in regard to the establishment and working of wireless stations. It is provided that sanction for the erection of a station shall only be given with the reserve of revocation at any time. The officials of the Imperial telegraph service and of the navy and army are empowered to exercise control over the stations. The owner of a station is placed under the obligation to take care that all messages received are kept secret under any circumstances, and the responsible officials are also authorised to suspend working temporarily. In the case of the reception of time signals, weather news, &c., it is stipulated that the apparatus shall work with the prescribed wave length of 1,650 metres, and any variation of this length by 5 per cent. in an upward or downward direction is to be prevented by a prescribed safety apparatus. Special instructions are given for the regulation of public communication between German coast stations and installations on ships. The latter have to be installed according to the conditions and regulations of the International Wireless Telegraphy Treaty, and ships in German ports are only allowed with the consent of the Post Office authorities to maintain a wireless service when in port. The coast and ship stations are placed under the obligation to undertake the mutual exchange of messages without any regard to the particular system used. It is added that the International Bureau of World Telegraphy of Berne is now publishing an official map of wireless stations, giving the nationality, system and the range in each case. Various wireless stations have been established in Germany without legal permission having been first obtained. The transgressors of the law are now threatened with legal proceedings and the demolition of their stations.

United States.—The Attorney-General has entered a civil suit under the Anti-Trust Law for the dissolution of the telephone monopoly alleged to be held on the Pacific coast by the American Telephone and Telegraph Co.

Uruguay.—The Government has been empowered to take up a loan of 380,000 pesos for the extension of the telegraph and telephone network, a portion of the lines is to be laid underground.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Victoria. — September 9th. Common-multiple switchboard. See "Official Notices" to-day.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

Queensland.—Brisbane.—September 10th. Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

Brisbane.—September 24th. Ironwork, cast-iron pipes, iron poles, galvanised iron wire, for the P.M.G. See "Official Notices" to-day.

Canberra.—September 1st. Commonwealth Department of Home Affairs. Switchgear for the power house at Canberra, the new Federal Capital in New South Wales. (1) Main power house switchgear; (2) Diesel engine switchgear. Tenders to the Secretary, Department of Home Affairs, Russell Street, Melbourne. Tenderers must state the earliest time of delivery. Deposit of 1 per cent. A copy of the specification, &c., together with a blue print, may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Belgium.—Ostend.—Tenders will shortly be called for for the installation of an electric sub-station at the Parc Léopold. Particulars at the Hôtel de Ville, Ostend.

Bournemouth.—August 27th. Reconstruction of 3 miles (single track) of permanent way for the Corporation Tramways Department. Mr. I. Bulfin, tramway manager. Deposit for specifications, £2.

Bradford.—August 30th. Machinery and timber, for the Corporation Tramways Department. See "Official Notices" to-day.

Brighouse.—August 9th. Cable and feeder pillars for the electricity department. See "Official Notices" August 1st.

Bury. — August 25th. One 2,000/3,000-kw. turbo-alternator, with exciter and surface condenser, for the Corporation. See "Official Notices" August 1st.

Dublin.—August 26th. Feed pump, cast-iron tanks, pipe work, valves, steam separators, boiler house shutters, coal grab and steel work, for the Corporation. See "Official Notices" August 1st.

France.—Havre.—Orders will shortly be placed for 15 electric cranes and the necessary transmission lines and accessories. Particulars of the Chambre du Commerc de Havre.

Egypt.—October 31st. Egyptian Ministry of the Interior. Machinery and plant required for the installation of electric light in the town of Damanhour: (1) generating plant and equipment, and the lighting of the central station; and (2) the distributing system. The offer may be for the complete installation or for either section. Sealed tenders to "Mons. le Directeur de la Section des Municipalités et Commissions Locales au Ministère de l'Interieur," Cairo. Copies of the *cahiers des charges* and plans can be seen at the same address, or obtained there on payment of 200 piastres (£2 1s.), which will not be returned. A provisional deposit of 2 per cent., or a bank guarantee of 10 per cent. of the value of the offer must accompany each tender.—*Board of Trade Journal.*

Frinton-on-Sea.—August 12th. Public lighting for the U.D.C. Mr. E. M. Bate, surveyor.

Hastings.—August 11th. Electrical installation at several schools for the T.C. Borough Electrical Engineer, Earl Street.

Kirkcaldy.—August 11th. Electric lighting of new school at Pathhead for the Kirkcaldy and Dysart School Board. Mr. W. Williamson, architect, Royal Bank Buildings.

London.—Royal Mint.—August 12th. 200 tons of copper in ingots. See "Official Notices" August 1st.

General Post Office.—September 1st. Stores Department. (1) Supply of Swedish, Norwegian, Finland or Russian red fir telegraph poles; (2) creosoting, &c., telegraph poles. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

L.C.C.—August 25th. Electrical installation, 320 lighting points, for Middle Row School, Kensal Road, N.W. See "Official Notices" to-day.

Manchester.—August 12th. The South Manchester Board of Guardians invite tenders for the electric light installation at the new Nurses' Home, West Didsbury. Specifications from F. H. Overmann, 49, King Street, Manchester, 10s. 6d. Tenders to David S. Bloomfield, Clerk to the Guardians, All Saints', Manchester, before August 12th.

Norwich.—August 12th. One 3,000-kw. turbo-alternator and surface condensing plant; rotary converters and E.H.T. switchgear for the Electricity Committee. See "Official Notices" July 18th.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" July 25th.

Puerto Plata.—The Government of the Republic of St. Domingo have voted 400,000 pesos for the improvement of the port, including landing and loading cranes and the building of a generating station. Particulars of the State Secretary for Agriculture and Traffic in Santa Domingo.

Shanghai.—August 26th. Two 5,000-kw. steam turbo-alternators, complete with surface-condensing plant; four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" July 25th.

South Africa.—September 10th. Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

Bloemfontein.—August 15th. Tenders for supply and equipment of electric tramways (railless) within the city, including poles, brackets, converting machinery, switchboard, and 10 railless vehicles. Plans and specifications on payment of £5 at the offices of Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C. See "Official Notices" July 25th.

Spain.—August 24th. Tenders are being invited by the municipal authorities of Almeria for the concession for the electric lighting of the town.

August 25th.—The municipal authorities of Elchi (Province of Alicante) are inviting tenders for the concession for the electric lighting of the town.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear for the Corporation. See "Official Notices" August 1st.

Wimbledon.—September 1st. One 1,500-kw. turbine alternator, condensing plant, auxiliaries, and 20-ton crane, for the Corporation. See "Official Notices" to-day.

York.—August 25th. Coal for a year from September 30th, for the Corporation electricity works (about 10,000 tons, either unscreened beans, pea slack, rough slack or small peas). Mr. J. W. Hame, engineer and manager, Clifford Street.

CLOSED.

Bolton.—The Electricity Committee has accepted the tender of the Electric Construction Co. for a booster in connection with the storage battery at the electricity works; and that of Messrs. Stewarts & Lloyds, Ltd., for steam and water pipes required at the proposed generating station at Back-o'-th'-Bank.

The Tramways Committee has accepted the tender of Walter Scott for the supply of steel tramway rails and fishplates required in connection with the relaying of the tramway track in Manchester Road.

(*Continued on page* 224.)

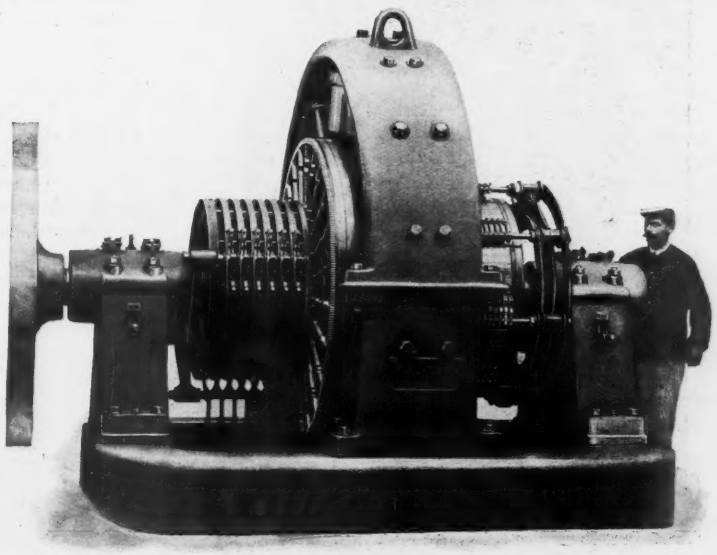
AN ELECTRIC RAILWAY IN THE FRENCH PYRENEES.

By Dr. ALFRED GRADENWITZ.

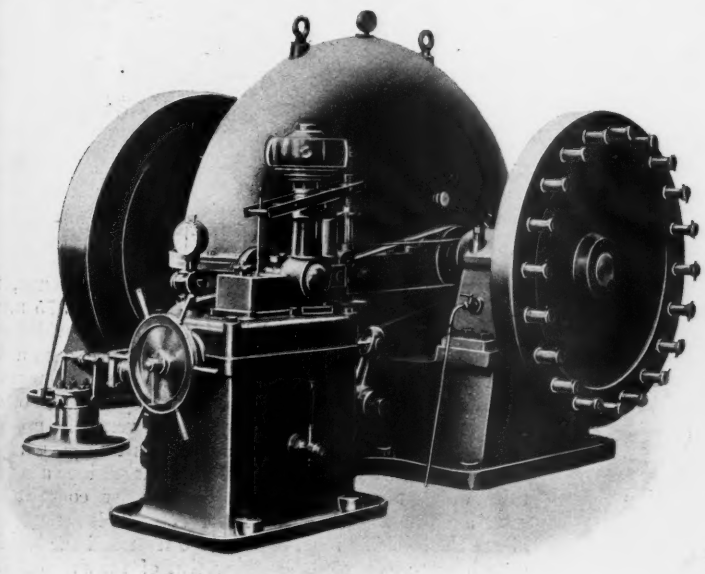
The Villefranche-Bourg-Madame Electric Railway is intended to serve French Cerdagne, and to connect this district with the remaining line of the Compagnie des Chemins de fer du Midi. Its starting point is at the railway station of Villefranche, the terminus of the Perpignan-Villefranche Line, at an altitude of 427 m. From Villefranche it rises in the valley of the River Tèt, up to the Perche defile, which it crosses at an altitude of 1,592 m. After then traversing some kilometres of the Perche Plateau, as far as the Col Rigart, the railway descends rapidly into the Cerdagne plain, terminating at Bourg-Madame, at 1,143 m. altitude and some hundred metres distance from the Spanish frontier. It is 55·96 km. in total length, and comprises two distinct sections. The first of these — from the starting point to Joncet (6·2 km.) —was designed in the first instance with a view to the installation of a standard-gauge railway, and generally offers no gradient superior to 25 per mille, the minimum radius of curves being 300 m., whereas on the second section (from Joncet to Bourg-Madame) are curves 80 m. in radius and gradients of 60 per mille. This part of the line comprises on the eastern slope a number of remarkable works, including the viaduct over the River Tèt at 18·10 km., and the rigid suspension bridge on the Gisclard system, 234 m. in span, at 24·5 km. The line also comprises 18 tunnels, representing a total length of some 2,378 m.

Electric traction was adopted mainly for administrative reasons, the water-power of the Upper Tèt being utilised in a hydroelectric power station situated at Cassagne at about 1,200 m. altitude. The watershed comprises the whole of the Carlitte Lake plateau, the water being collected in a storage reservoir, 13 to 14 million cubic m. in capacity, with a masonry embankment 13 m. high, which raises the water level of the Bouillouse swamps to an altitude of 2,009 m.

The programme to be provided for in constructing this remarkable railway comprised the running of trains 120 tons in total weight throughout the length of the line; moreover, provision had to be made for trains of equal weight to be run 10 minutes after each schedule train.



Double-Current Generator, of 650—1,000 kw.



Pelton Turbine of 1,500 h.p.

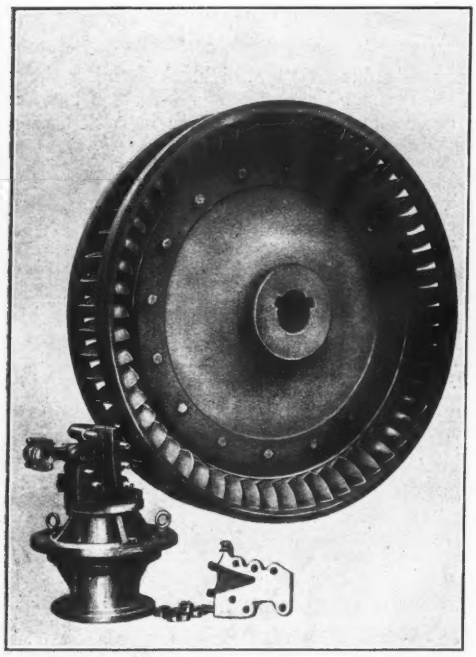
Continuous current was adopted for the operation of the railway, a contact rail installed at the side being used to distribute current to the traction motors, on account of the considerable weights to be transported. Contracts for the supply and installation of the whole equipment were concluded with the Société Alsacienne de Constructions Mécaniques, of Belfort and Mulhouse.

The distribution system comprises five sub-stations, each of which, like the power station, supplies the contact line with continuous current at 850 volts, the average distance between each two feeding points being about 11 km. The sub-stations are connected to the power house by a 20,000-volt line, and they all work in parallel on the contact rail.

The power house contains exclusively double-current generators, which supply as required either 850-volt continuous current for directly feeding the contact rails, or three-phase current at 25 cycles for the feeding of the sub-stations (through the intermediary of the high-tension line). The adoption of double-current generators, which is one of the most remarkable features of the installation, allowed the first cost to be reduced considerably by dispensing with the installation of special D.C. generators.

The equipment of each of the sub-stations consists of rotary converters fed through step-down transformers. This mode of distribution allows an automatic regulation

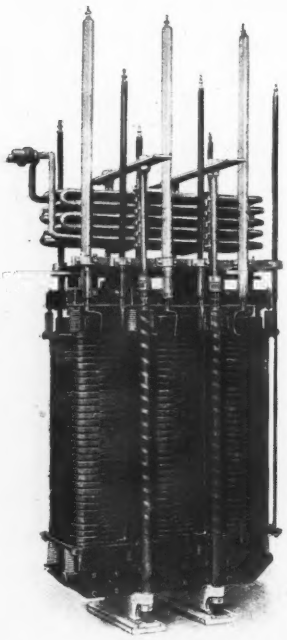
of the pressure to be readily effected at the feeding points of the contact rail. The generators and rotary converters are for this purpose provided with an additional series field winding, calculated with a view to raising the pressure of



Rotor and Nozzle of Turbine.

these machines from 800 volts at no load to 850 volts at full load.

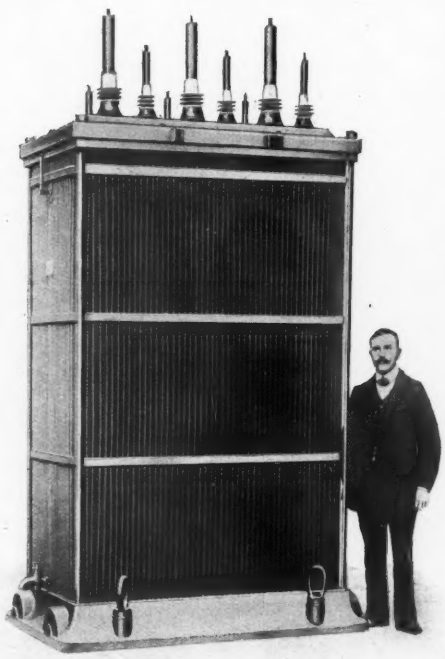
The Cassagne power house is situated on the River Tèt at an altitude of 1,196 m., at 24 km., and 250 m. from the railway. It comprises, in addition to an engine room,



Three-Phase Transformer, 650 kw., 20,000 Volts, with Cooling Coil.

served by a 10-ton travelling crane, a basement where the hydraulic distributor and the transformers are installed. Its aggregate capacity is 6,000 h.p., subdivided into 4 units each of 1,500 h.p. It is designed for utilising a total gross head of about 420 m., the net head being about 380 m. The water is obtained from the River Tèt by means of an intake connected to the forebay by an open masonry conduit 4,426 m. in total length, which passes through two open-air settling tanks. From the forebay run four pressure conduits, 400 mm. in external diameter, which terminate at the distributor in the power house; each of these conduits is 1,001 m. in total length. The distributor, which is made of cast-steel throughout, is situated in the basement, being connected to each of the turbines by an ascending conduit. It is subdivided into two parts, which can be isolated from one another by means of a gate valve situated in the centre. In each of these two parts terminate two twin conduits, a special gate valve allowing each conduit separately to be isolated from the distributor. A gravel catcher and discharge cock have been provided to prevent pebbles and other bodies from entering the distributor. Protection against hydraulic shock is provided—apart from the pressure regulators to be described later—by six safety valves, connected to each of the four conduits and to each of the two halves of the distributor. The ascending conduit to each of the turbines contains two gate valves, controlled by hand and by an electric servomotor respectively.

The turbines, on the Pelton system, have been designed



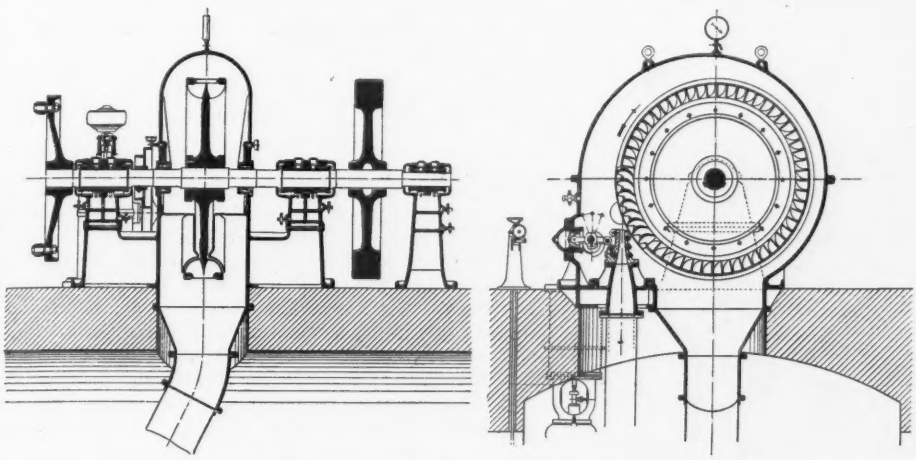
Transformer in Tank.

and constructed at the works of the Société Alsacienne, the output of each unit being 1,500 h.p. at a speed of 375 r.p.m. The blade rim is made of special cast-steel and is provided with bands to deal with centrifugal stresses; it is bolted on a disk constituting the nave, which allows any worn-out parts to be readily replaced. The jet is obtained by a single bronze nozzle, the tongue of which is directed vertically upwards and balanced hydraulically by a compensating piston. On leaving the turbine the water is discharged into a suction tube which terminates in a lower masonry compartment with an outflow towards the River Tèt. This arrangement allows the level difference between the river and the turbines (which on account of the configuration of the site could not be installed any lower) to be fully utilised.

The turbine shaft is of crucible steel, and is connected to the generator shaft by an elastic clutch with removable rubber buffers. It rests on two water-cooled bearings. At the opposite end the extension of the shaft carries a cast-steel fly-wheel, 5 tons in weight and 2 m. in diameter, which is partly supported by a rear bearing likewise provided with water cooling.

The speed of each turbine is automatically controlled by a patented self-contained speed regulator on the Minetti

system. This oil-pressure regulator mainly consists of an oil tank, two single-acting pistons moving in cylinders, which are connected by a rod actuating, through the intermediary of a regulating shaft, the gate valve of the turbine, two rotary high-pressure oil pumps, a distribution valve and a centrifugal governor. Each cylinder communicates on one hand with the pressure pipes of one of the pumps, and, on the other, with one of the discharge openings controlled by the distribution valve. During normal working the distribution valve is in its central position, and uncovers equal parts of the discharge openings of the cylinders, thus allowing the oil supplied to the cylinder to return to the tank without exerting any appreciable pressure on the pistons. As soon as, on account of a variation in torque, the speed of the motor tends to increase or decrease, the distribution valve under the action of the centrifugal governor closes one or other of the discharge openings. The oil supplied by the pump feeding the closed cylinder being unable to return to the tank, then compels the corresponding piston to move, thus actuating the gate valve connected to the piston shaft. As the oil in normal working circulates practically under no pressure, the energy absorbed by the pumps is negligible. A safety valve has been provided to prevent any abnormal increase in pressure. This valve, by a simple manipulation of a lever, also allows the two cylinders of the servomotor to be connected together, thus interrupting the action of the regulator, whenever the regulation of the turbine is to be effected by hand, by means of a special hand wheel. A safety device has been provided to avoid racing in the event of an accident to the governor.

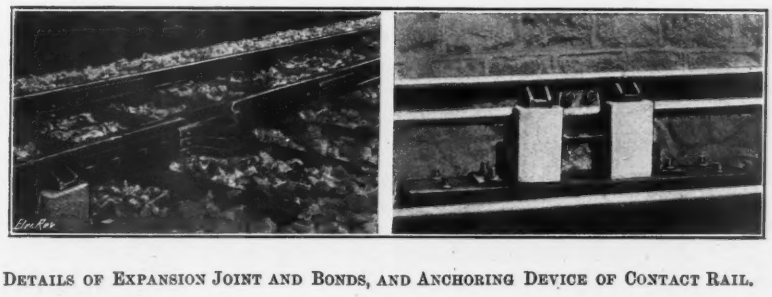


Longitudinal and Transverse Sections of Pelton Turbine of 1,500 h p.

This speed regulator reduces variations in the speed of the turbine in the event of an abrupt relief of 15, 30 or 100 per cent. of the total load, to less than ·5 per cent., 2·7 per cent. and 10 per cent. of the normal figures respectively.

Each of the turbines also possesses a pressure regulator, designed to prevent any hydraulic shock produced by the very quick action of the speed regulator. This apparatus is connected in parallel to the ascending feeding conduit; it is controlled by the regulating shaft acting on the injector pump, and opens on the feeding conduit a discharge opening which is larger as the regulator works with greater amplitude. It mainly consists of a cylinder arranged at the end of a lever, mounted on and positively connected with the regulating shaft. In this cylinder moves a differential piston submitted on its two faces to the pressure of the water, and provided with a narrow opening which connects the two sides of the piston with one another. This piston controls the opening and closing of the discharge aperture.

When the action of the speed regulator, for instance, tends to reduce the admission of water, the regulator shaft carries the cylinder and its piston along, and the latter, on account of the small cross-section of the piston opening, only makes a relatively small movement. The discharge aperture is thus opened, but the pressure difference on the two sides of the differential piston comes into play immediately, returning the piston to its initial position, and closing again the discharge aperture slowly enough to avoid any objectionable excess pressure.



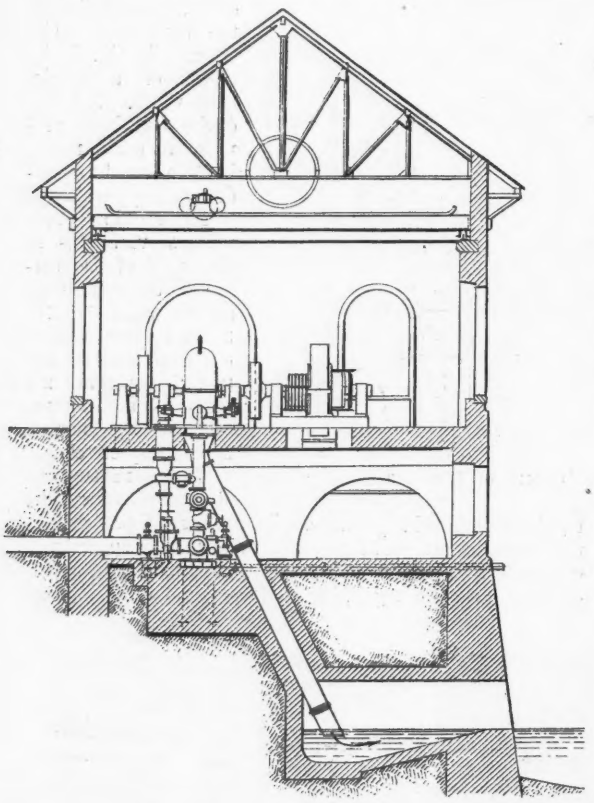
Details of Expansion Joint and Bonds, and Anchoring Device of Contact Rail.

20,000-volt Transmission Line.

Gisclard Suspension Bridge.

The guaranteed efficiency of each turbine, inclusive of accessory apparatus and water leakage, was 75 per cent. Tests on delivery have shown the efficiency to be in reality 78 per cent., or 82 per cent. for the turbine alone.

The electrical equipment of the power house comprises four double-current generators coupled by sleeves to the water turbines, four step-up transformers each connected to

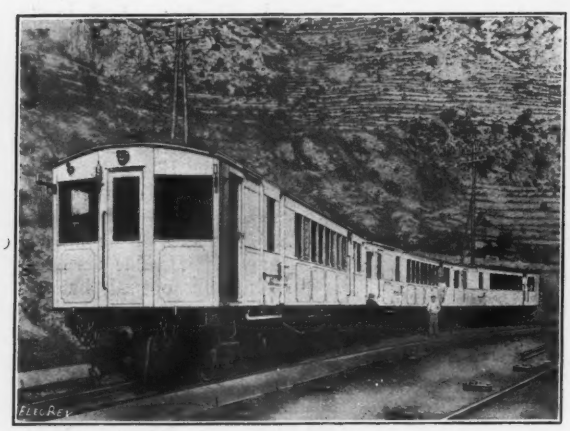


Section of Generating Station.

one of the generators, and, finally, an auxiliary converter set supplying the current required for lighting and for the operation of the servomotors actuating the hydraulic distribution valves.

The double-current generators are of the fixed-field rotating-armature type, and are designed for a normal output of 650 KW., in the form either of 850-volt continuous current or 600-volt six-phase current at the frequency of 25 cycles and the speed of 375 R.P.M.; they therefore have eight poles.

The drum-wound armature is of the ordinary D.C. type, provided with six bronze collecting rings, each communicating with a fixed point of the armature. The field magnet



Electric Train, Villefranche-Bourg-Madame Railway.

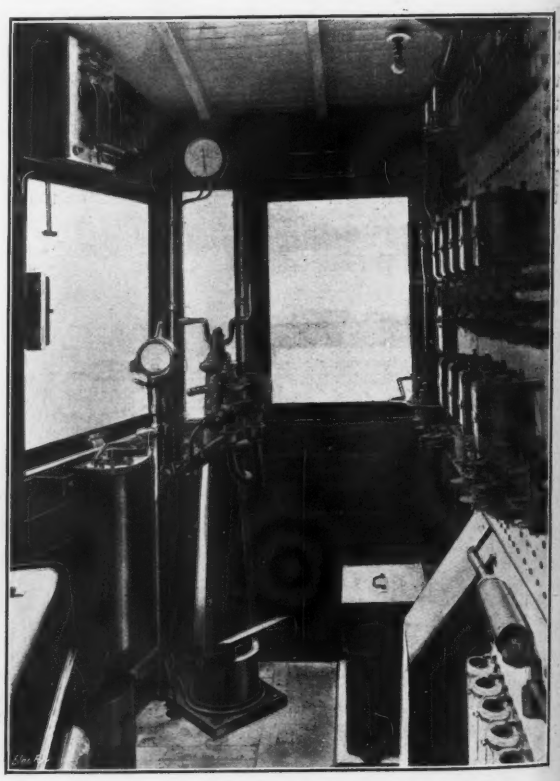
is made of cast-steel with laminated poles, provided with a shunt and a series winding, the latter being so calculated that the voltage of the machine, when working at constant speed as a D.C. generator, rises from 800 to 850 volts, between no load and full load. Apart from the main pole-pieces, the yoke carries eight auxiliary commutation poles, which ensure, with fixed brushes, excellent commutation even at the highest overloads.

These generators are calculated for a maximum heating of 45° C. above the surrounding temperature in continuous operation when yielding an output of 650 KW.; they are also to stand without any abnormal heating an instantaneous overload of 60 per cent., corresponding to a useful output of more than 1,000 KW. The efficiency at full continuous-current load is 93·7 per cent.

The transformers have, like the corresponding generators, an output of 650 KW., at 25 cycles. The primary windings are designed for 600-volt six-phase current, and the secondary windings for supplying three-phase current at 20,000 volts, in star connection.

The transformers are of the oil-bath type with water-cooling by means of a spiral tube in the upper part of the tank. They are calculated for a maximum rise of temperature of 50° C. above the surrounding atmosphere, after 24 hours' continuous working at full load. After an overload of 25 per cent. during two consecutive hours, the rise in temperature does not exceed 60° C. Finally, they are able without any objectionable heating to stand an overload of 100 per cent. during five minutes. Their efficiency at full load is 97·2 per cent., the pressure drop at full load being 1·4 per cent. with $\cos \phi = 1$. Each of them is connected directly to the corresponding generator by cables in which only switches and fuses are inserted; there are thus no bus-bars between the generators and transformers, each transformer with the corresponding generator constituting an indivisible unit.

The switchboard is designed for controlling, apart from the four generator sets, a system of outgoing 850-volt D.C. conductors, and two overhead lines at 20,000 volts. It is subdivided into two separate parts, viz., on one hand the switchboard proper, and on the other the high-tension apparatus which is located at the end of the engine room on



Interior of Driver's Cab.

a special platform. The switchboard proper comprises six white marble panels mounted on metal frames, and installed on a marble platform, situated 0·80 m. above the floor of

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the engine room, so as to facilitate superintendence. The four central panels are intended for the generator sets, and the two side panels are set apart respectively for the D.C. line, and for two 20,000-volt lines, together with the coupling switches for the machines working as alternators. The D.C. bus-bars are three in number, the positive bar being connected to the contact rail, and the negative bar to earth, while the third one acts as a balancing bar.

On the D.C. side, the apparatus of each set comprises a double-pole hand switch mounted on the cables terminating at the negative and balancing bars, and an automatic maximum circuit-breaker with a magnetic blow-out protecting the generator against excessive overloads.

On the A.C. side a three-pole oil switch is connected between the secondary windings of the step-up transformers and the 20,000-volt bus-bars. This switch is provided with a self-acting releasing relay on two phases, so as to protect the set against the consequences of a short-circuit between any two phases; a time-lag relay allows the duration of overload, after which the releasing takes place, to be adjusted at will. The circuit-breakers of the generators are, like those of the outgoing lines, situated in masonry cells at the end of the building. They are controlled from the switchboard by solenoids which, like the releasing relays, are fed with 850-volt continuous current, but they are also designed for being operated directly by hand.

The apparatus for coupling the generators when working as alternators comprise an Everett synchroscope, a line voltmeter and a phase voltmeter, all these apparatus being fed by a potential transformer. On the panel carrying these apparatus there are also fixed the switches controlling at a distance the oil switches of the 20,000-volt overhead line. These circuit-breakers, which, like the others, are placed in cells at the end of the room, are provided with releasing relays with time lag in three phases. The 20,000-volt bus-bars are placed horizontally on brackets, and take up the upper part of the engine room. On the wall of the latter are a series of vertical masonry partitions forming cells, through which the conductors connecting the oil switches on the ground floor with the bus-bars pass. Each of the cells contains a disconnecting switch, and, wherever required, a maximum relay controlling the automatic release of the circuit-breaker. The apparatus of the two outgoing high-tension lines is installed on the gable wall of the building and on two transverse walls, and comprises, in addition to lightning arresters, a section switch in each phase.

Protection against atmospheric discharges is ensured primarily by a continuous-action water-jet discharger, and, secondly, by a double set of lightning arresters and self-induction coils. Care has been taken to avoid any accidents likely to result from the casual contact of a high-tension conductor with any metal framework. All frames or metal parts situated in the neighbourhood of these conductors have for this purpose been carefully earthed.

Lighting current for the power house is supplied by a 9-KW. converter set running at 950 R.P.M. This comprises an 850-volt motor connected up to the bus-bars of the switchboard, and a 110-volt D.C. generator, which also supplies the servomotors of the gate valves. Thanks to the extended use of electric remote control, the electrician, without leaving his post at the switchboard, is able to start or stop any one of the generator sets.

The high-tension line connecting the power house to each of the five sub-stations follows almost throughout its course the railway track, and thus is about 55·7 km. in total length. This arrangement simplifies and facilitates the supervision and upkeep of the line.

The overhead line is duplicated throughout its length, and comprises six conductors. It is carried by pinewood poles impregnated with copper sulphate, the maximum spans being 40 m., and the average spans 35 m. The insulators are mounted on two horizontal arms, the upper one carrying two and the lower one four insulators. The standard poles are 11 m. in total length, and are planted in the ground to a depth of 2 m. Three crossings of the River Têt as well as that of the Jardo ravine, on account of the considerable spans, necessitated the installation of steel girder poles on concrete blocks.

The high-tension porcelain insulators are of the triple-bell type and are amply dimensioned. Before being shipped they were tested at a pressure of 80,000 volts in air and 40,000 volts in acidulated water.

The most serious difficulties were encountered in connection with the tunnels. While some of these could be readily passed over by the overhead line, difficulties of upkeep in the case of some other tunnels rendered the installation of overhead lines practically impossible. Such tunnels were traversed by means of armoured and lead-sheathed cables passing through their interior and fixed to the tunnel vault by means of clips embedded in the masonry. These cables, which were also constructed at the works of the Société Alsacienne, each have three cores of 10 sq. mm. cross-section. Care was taken to protect them against excessive atmospheric pressures by installing lightning arresters at the end of each tunnel. In order to allow any damaged section to be rapidly isolated from the remainder and the load to be transferred from one line to the other, six section posts were installed, at the Cassagne power house and at each of the five sub-stations respectively. These section posts, situated outside in the immediate neighbourhood of the station buildings, each consist of a horizontal metal frame carried by four poles at a height of about 7·60 m. above the ground. This frame carries, in addition to the insulators, section switches of the horn and air-gap type, which are actuated from the ground by means of a handle controlling a system of levers.

After the inauguration of the railway line, the Compagnie du Midi, for reasons independent of the Villefranche-Bourg-Madame Electric Railway, were induced to substitute for the conductors above described between the Cassagne power house and Villefranche, a double line constituted of six aluminium conductors (three of 30 sq. mm. and three of 70 sq. mm. cross-section respectively) carried on ferro-concrete poles.

All five sub-stations are situated in the immediate neighbourhood of the railway. Their electrical equipment is identical, and comprises duplicate plants, each consisting of a step-down transformer feeding a rotary converter. While their normal output is 600 KW., each of these sets is able, during periods of 15 minutes separated by intervals of equal duration, to supply 1,000 KW., as well as to stand momentary overloads of up to 1,200 KW.

The primaries of the transformers are designed for a pressure of 20,000 volts, and their secondaries for supplying six-phase 600-volt current to feed the rotary converters. The design of these transformers is very similar to that of the step-up transformer in the power house.

The rotary converters supply continuous current at 850 volts; they have 12 poles, and run at 250 R.P.M. They resemble the generators with respect to their constructional details, but for the absence of auxiliary poles, which in the present case were not required to ensure good commutation at all loads.

The contact line consists of a rail of extra soft steel supported on sandstone insulators. This rail is of the double-headed type, and weighs 39 kg. per metre; its composition was chosen so as to ensure an electrical resistance as low as possible, the proportions of the various impurities not exceeding the following figures:—Carbon, 0·09 per cent.; silicon, 0·09 per cent.; sulphur, 0·05 per cent.; phosphorus, 0·03 per cent.; manganese, 0·42 per cent.

This composition corresponds to a specific resistance practically equal to 6·5 times that of copper.

The insulators each consist of a rectangular block of varnished sandstone, slotted on the top to receive the contact rail. So far from resting directly on the sleepers of the railway track, these insulators are placed on creosoted pine-wood brackets plugged on the sleepers, and are thus able to adjust themselves to suit the contact rail. The latter rests on the insulator through the intermediary of a tie-plate of anti-friction metal. The centre of the contact rail is 600 mm. from the inner edge of the adjoining rail, and the upper edge of the contact rail 250 mm. above the travelling level of the track. The contact rail was placed as high as possible in order to reduce to some extent the risk of break-down due to snowfalls.

The electrical equipment of the contact rail is completed by section switches installed in boxes alongside of the track, which allow either part of the station tracks or the section of the contact rail between two neighbouring stations to be

isolated at will. The contact rail is provided with a series of mechanical arrangements intended to counteract the effects of heat expansion, which are bound to occur, especially in the upper parts of the line, where variations in temperature in the course of a year reach a total amplitude of about 70° C. The contact rail has, therefore, been subdivided into a certain number of sections which are solidly anchored in the centre and fitted at the ends with sliding expansion joints.

The current return is effected by the travelling rails, which are of the Vignoles type with angle fish-plates, weighing 30 kg. per m. The two lengths of rail are connected together at points 100 m. apart by transverse tinned copper wires. The contact line is connected up to the switchboards of each of the five sub-stations and the power-house by an armoured lead-covered cable 500 sq. mm. in cross-section.

The rolling stock comprises 20 two-bogie motor-cars, viz., 10 passenger motor-cars and 10 motor-vans, the electrical equipment of all of which is identical.

The passenger motor-cars each contain between the two driver's cabs a first-class compartment with eight seats, a second-class compartment with 32 seats and a luggage compartment. Each motor-van contains only one separate driver's cab, the other driver's stand being at the opposite end in the car itself. These motor-cars have been constructed to the order of the Société Alsacienne at the works of Messrs. Carde et Fils et Compagnie, of Bordeaux.

The equipment of each motor-car comprises four traction motors each of a normal output of 50-55 H.P., driving the axles through the intermediary of a simple set of gears in the ratio of 1:4·3. Each motor is wound for 375 volts, the two motors of the same bogie being permanently connected up in series for a total pressure of 800-850 volts.

The electrical equipment is designed for electric braking on going down hill—the motors working as dynamos on resistances. The motor control is on the Sprague multiple-unit system, each controller comprising three forward positions and one reverse, as well as three electric braking positions.

Heating is effected by electric heaters located below the passengers' feet and in the driver's cabs respectively. Each of the lighting circuits comprises seven series lamps fed at a pressure of 800-850 volts, and a balancing iron resistance intended to ensure an approximately steady feeding voltage of the lamps, in spite of fluctuations in the voltage of the mains.

The electrical equipment allows the following approximate speeds to be obtained on different gradients with a total load of 40 tons per motor-car :—On the level, 40·4 km. per hour ; on a gradient of 25 per mille, 34 km. per hour ; on a gradient of 60 per mille, 20-21 km. per hour. The maximum speed authorised on gradients of less than 33 per mille is 50 km. per hour. Apart from the motor-cars, the rolling stock comprises 14 two-bogie passenger trailers and about 150 two-axle goods cars of various types.

CONTRACTS CLOSED.

(*Concluded from page* 218.)

Bridlington.—The T.C. has accepted the tender of Mr. W. B. Wilson, of York, for coal (1,500 to 2,000 tons) for the electricity works.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs Johnson & Phillips, Ltd., for electric cable.

Burnley.—The Corporation Electricity Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co. for turbo-alternator, rotary converters, switchgear and other work, at £12,860. A supply of cables has been ordered from B.I. and Helsby Cables, Ltd.

Canterbury.—The T.C. has accepted the tender of the East Kent Colliery Co., Ltd., of Tilmanstone Colliery, for fine slack coal for the electricity works, at 16s. per ton ; and that of Messrs. Wm Cory & Son for Nixon's navigation large steam Welsh coal, at £1 11s. 5d. per ton, and Rochester house coal screenings or Scotch washed singles, at 19s. 10d. per ton.

Cleckheaton.—The U.D.C. has accepted the tender of the Cleckheaton Colliery Co., Ltd., for 1,000 tons of coal for the electricity works, and that of Messrs. W. H. Sharp & Sons for 250 tons.

Eccles.—The Public Lighting and Electricity Committee has accepted the following tenders :—

Triumph Stoker Co.—Mechanical stokers, £423.
Messrs. Sugden.—Superheater, £85.

Gillingham (Kent).—The T.C. has accepted the tender of Messrs. G. Gates & Son, of Frindsbury, for extensions to the engine room and boiler house at the electricity works, at £1,928.

Glasgow.—The T.C. has accepted the offer (£1,369) of the North British Lifting and Moving Appliance Co., Ltd., for 16 sets of worm-gear hoists for the abattoirs at Moore Street.

Halifax.—The Tramways and Electricity Committee has accepted the following tenders :—

B.I. and Helsby Cables, Ltd.—6,000-volt overhead three-phase line, £1,076.
Balcke & Co., Ltd.—Water cooling tower, £950.

Lancaster.—The Borough Education Committee has accepted the tender of Mr. H. Renton, of Morecambe, for the electric light installation at the Grammar School, at £344.

The Tramways Committee has accepted the tender of the Electric Car Co., of Preston, for two top-deck covers for tramcars.

London.—Shoreditch.—The Guardians have accepted an estimate (£65) of the Hackney B.C. for installing electric light at the Branch School. The wiring is to be in screwed grip tubing.

Bermondsey.—The Board of Guardians received the following tenders for alterations and additions to the electric light installation at the Infirmary :—

Malcolm & Allan, Ltd.	£712
Wm. Langley	700
W. J. Gray & Son	609
G. H. Cathcart & Co. (10s. per point extra lights)	545
A.E.G. Electric Co.	545
W. Mackie & Co.	496
S. C. Robson (12s. 6d. per point extra lights)	495
W. R. Reynolds, Ltd. (accepted)	449

Middlesex.—The County Council has accepted the tender of Messrs. Martyn & Co., at £1,960, for electric light fittings required at the new Guildhall.

Mirfield.—Messrs. A. Brook & Co. have secured the contract for installing the electric light at St. Paul's Church, Mirfield.

Paisley.—Messrs. A. E. Holms, McPhail & Co., have secured the contract for the lighting of the Marquis of Bute's mansion-house of Mount Stuart, Bute. The contract embraces a complete lighting installation for the house, and the provision of power for cooking, heating and ventilation. There will be upwards of 2,500 lights in the installation and the mode of decoration, it is stated, will be on novel lines. The motive power for the plant, though not yet decided upon, will, in all probability, be suction gas or Diesel engines. It is estimated that over two years will be occupied in completing the work.

Peterborough.—The T.C. has signed contracts with Messrs. Willans & Robinson. Ltd., for a 500-kw. generator and steam turbine, and Messrs. F. Danks, Ltd., of Oldbury, for two Lancashire boilers for the electricity works.

Salford.—The T.C. has accepted the tender of the Tudor Accumulator Co. for welding about 350 tramway rail joints, at 30s. per joint. The following tenders have also been accepted :—

Browett, Lindley & Co., Ltd.—Fixing steel exhaust pipes with special cast-iron bends ; also automatic non-return valve to No. 4 engine at the electricity station, £130.
C. Richards & Sons.—Tie bars for tramways, £177.
Bayliss, Jones & Bayliss, Ltd.—Tie bars for tramways, £205.

Eight months' supplies :—

Le Carbone.—Motor carbon brushes, £70.
Sloan Electrical Co.—Arc lamp carbons, £50.
H. Green & Co. and General Electric Co., Ltd.—Electric motors, £1,500 each.

Annual supplies :—

Clifton and Kersley Coal Co., Ltd.—2,000 tons No. 2 best washed slack, 12s. 10d. and 13s. 8d. per ton according to mode of delivery ; 5,000 tons No. 4 washed nuts, 14s. and 14s. 10d.
A. Knowles & Sons, Ltd.—12,000 tons No. 2 best washed slack, 12s. 10d. and 14s. 1d.
Earl of Ellesmere.—7,500 tons No. 2 best washed slack, 12s. and 13s. 4d.

West Bromwich.—The T.C. has accepted the tender of the Union Cable Co., for cables, and renewed the contract for a year with the Aron Electricity Meter Co., Ltd., for the repair of Aron meters.

Whitwood.—A large order for mining telephone apparatus has been placed with Messrs. Scattergood & Johnson, of Leeds. The installation is to be carried out by Mr. Walter Robb, lighting and power contractor, of Wakefield.

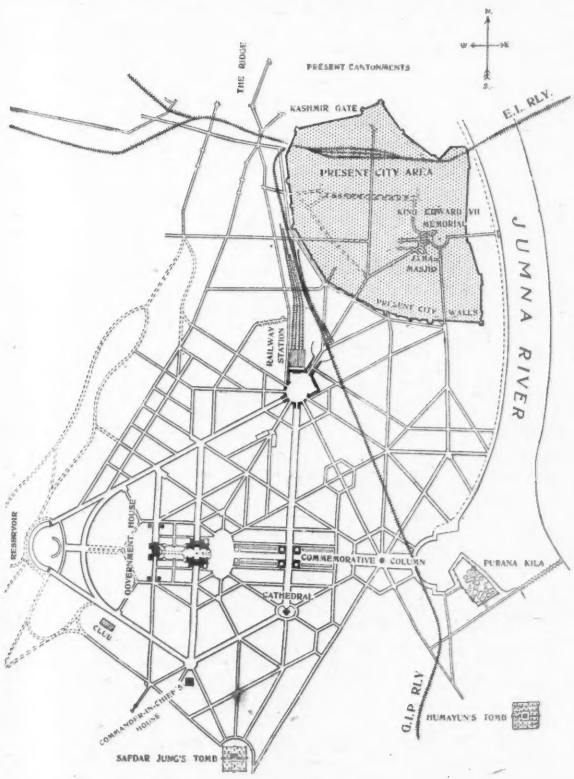
Willesden.—The Electricity Committee has accepted the tender of Messrs. Crompton & Co., at £440, for the renewal of the D.C. switchboard at the Salusbury Road sub-station, and sanctioned a further expenditure during the current year.

NOTES.

Proposed Electrical Manufacturing Rifle League.—A correspondent writes as follows:—"In connection with these works we are running a Miniature Rifle Club, but at the moment we have not identified ourselves with any League. Being an electrical firm (London), we should like if possible to join a League made up of clubs from similar manufacturing firms. There is no such organisation, so far as I am aware, but as clubs are being formed by some other electrical manufacturers, it occurred to me that the time might be opportune for the formation of an Electrical League. If you will kindly make the suggestion in your columns, we could no doubt obtain an expression of opinion on the subject, and in the event of a sufficient number of firms being interested, the matter could be started without delay. As an alternative suggestion, the Electric Supply Companies League may be willing to extend their membership to a limited number of clubs from manufacturing firms."

We need hardly say that we hope that this proposal will receive ample support. We shall be pleased to forward to our correspondent any communications that we may receive (addressed to "Alpha") from those interested in this subject.

The New Delhi.—Our Indian correspondent sends us the accompanying map of new Delhi, which is a reduction of the one published by the Delhi Town Planning Committee, and is interesting as showing the possibilities of future street lighting. The entire electrical work will, of course, be in the able hands of



Mr. J. S. Pitkeathly, C.V.O., the electrical engineer to the new Delhi Province, and it may be taken for granted that an electric scheme worthy of the new capital will be developed in due course.

American Power Plant Fire.—Our Chicago namesake records that the power station of the Commonwealth Power Co., at Albion, Mich., was destroyed by fire on June 30th. During a severe storm a lightning stroke was conveyed into the building from the high-tension lines, and fire was started at the switches. The machinery was damaged beyond repair, and will have to be replaced.

Educational Note.—The next session of the Engineering Department of Edinburgh University opens on October 7th, and particulars are given in our advertisement pages to-day.

Driving Systems for Submarines.—In the course of a long paper dealing with the development of submarines and submersibles and their propelling equipment, G. Berling* deals with several matters of electrical interest. Usually, submarines are driven on the surface by oil engines which also, during such cruising periods, drive dynamos charging a large battery of accumulators. When the vessel runs submerged, the "dynamos" are driven as motors from the secondary cells and the oil engines are shut down. The weight of modern oil engines of type and size suited to this service, averages from 62 to 70 lb. per H.P. (including the necessary starting gear and the main shafting and propellers, &c.). Electric motors and the necessary control gear weigh about 132 lb. per H.P., and leading particulars of modern lead accumulators are compared, in the following table, with those of Edison cells:—

	Lead.	Edison.
First cost per H.P.-hour capacity...	78s. 6d.	280s.
Life (discharges)	400 (average experience)	800 (guaranteed)
Cleaning necessary every... ...	two years	two years
One hour discharge	permissible	not permissible
Per H.P.-hour (3½-hr. discharge)—		
Weight (lb.)	78	72
Space occupied (cb. ft.) ...	0·41	0·51
Ampere-hour efficiency (%) ...	90	75
Watt-hour efficiency (%)... ...	75	55
Voltage drop on discharge (%) ...	10	18
Average voltage per cell	1·92	1·2

Normally, recharging storage cells occupies from 6 to 10 hours, but, since the vessel is bound to remain on the surface during the charging period, it is important that the cells should be able to withstand abnormally rapid charging in case of emergency.

Owing to the very heavy hull construction required to withstand the hydrostatic pressure at depths of 150-170 ft. (with a factor of safety of 2½), and owing to the great weight of the supplementary equipment required to provide for under-water propulsion (85 per cent. of the total driving-machinery weight), it is impossible to increase greatly the speed of a submarine by increasing its tonnage and the H.P. of its surface-driving equipment. The causes mentioned above must always prevent the weight of the driving machinery of a submarine being more than a fraction as effective (in point of power and speed) as that of the machinery in other war vessels. It is a noteworthy fact, however, that only the accumulator-electric motor equipment possesses a sufficiently high "specific gravity" to enable the permissible weight of supplementary ("submerged") propelling machinery to be accommodated in the space available. By carrying cylinders of compressed air or oxygen, it is possible to use the main oil engines for submerged—as well as for surface—propulsion, and, by the provision of oil-fired and steam-soda boilers, it is possible to use the same steam engines for surface and under-water cruising, but in all such alternative systems it is necessary to carry more or less idle ballast to make up the necessary total "submerged displacement," after all the available space has been filled with the air bottles, soda boilers or other supplementary equipment required to make possible the use of the main oil or steam engines when the vessel is submerged.

German Electrical Exports.—Although the promotion by German electrical companies of lighting and traction undertakings in other countries has been adversely criticised at different times on the ground of the withdrawal of capital from the German market, it is becoming recognised that, apart from the dividends received from the foreign investments, the latter are also the means of bringing orders to the manufacturing firms, as is shown by the continued expansion in the exports. During the first six months of 1913, the exports have been as follows, as compared with the corresponding half-year in 1912:—

	1913. *First half.*	1912. *First half.*
Dynamos, motors, transformers, &c. ...	£1,321,500	£1,147,500
Armatures and commutators	189,500	148,500
Secondary batteries and electrodes ...	122,700	155,700
Cables	913,000	542,000
Arc lamps, mercury vapour lamps, &c.	70,200	65,100
Searchlights, &c.	58,100	23,200
Metal-filament lamps	980,000	1,113,000
Carbon-filament lamps	95,200	80,200
Telegraph apparatus	27,500	35,700
Telephone apparatus	181,000	128,000
Safety and signalling apparatus ...	93,000	92,000
Wireless telegraph & telephone apparatus	35,000	37,000
Apparatus for lighting, power transmission, &c.	1,261,000	870,000
Medical apparatus	99,000	98,000
Measuring apparatus	555,000	404,000
Primary batteries	58,000	38,000
Insulating tubes	72,000	60,000

The aggregate value for the first half of 1913 is returned at £6,238,000, as contrasted with £5,119,000 in the equivalent period in 1912. On the other hand, the value of the imports amounted to £311,000 and £254,000 in the same half-years respectively.

Liverpool and District Amateur Wireless Association.—A meeting of this Association was held on July 31st, when it was announced that Prof. E. W. Marchant, D.Sc., and Mr. L. S. Cohen, had both consented to act as vice-presidents. The subject of "extreme" protection against lightning risks was again referred to, when it was suggested that a double-pole two-way switch could be used for the purpose of earthing both aerial and also metal guy ropes, if thought necessary. To-morrow afternoon the Association is paying a visit to the Formby power station of the L. & Y. Railway, with a view to seeing the generation of electrical energy on a large scale, and the feature of the evening was a full description of the Liverpool and Southport Electrical Rail-

* 1913 Jahrbuch der Schiffbautechnischen Gesellschaft.

way, of which Formby is the power centre. The subject was dealt with by the hon. secretary and treasurer—Mr. Samuel Frith, of Crosby. In the course of his remarks, Mr. Frith gave some interesting data, showing the working conditions of the plant.

Forged Share Certificates.—A few weeks ago the existence of a number of clumsily forged share certificates of the Société d'Electricité de Paris was discovered in Paris, and an investigation was at once commenced. Since then an attempt has been made to place such certificates in circulation in Belgium through an exchange bureau at Brussels, but the police were successful, it is said, in arresting the persons. The counterfeit certificates are easily distinguishable from the genuine ones, as not only the colour, to some extent, but also the text does not agree with the original.

International Electrotechnical Commission.—A meeting of the above will be held in Berlin from September 1st to 6th :—

Special committees will meet (Monday) on nomenclature—rating; (Tuesday) on symbols, prime movers, and rating (continuation). The official opening takes place on Wednesday, September 3rd. Working sessions of the whole commission to draw up, in definite form, various resolutions for ratification at the plenary meeting, occupy Wednesday afternoon and Thursday, followed by the plenary meeting on the Friday.

The special committees on nomenclature, symbols, rating of electrical machinery and prime movers, which have been working continuously since the Turin meeting of 1911, are to hold meetings in Berlin prior to those of the full commission, in order to have a further opportunity of discussing the latest modifications to their reports, suggested by the National Committees. The result of these meetings will be embodied in the reports, which, thus modified, will be considered at working sessions of the whole commission. When agreed to in their final form, they will be submitted to the plenary meeting for ratification.

It is probable that the honour of the Presidency of the Commission, which would have been conferred on M. Mascart, had he lived, will be offered to an eminent French electrical engineer by the Council of the Commission at its closing meeting on the Friday.

Parliamentary.—Metropolitan Electric Railways Bill.—A Select Committee of the House of Commons on July 30th passed the Bill promoted by the Metropolitan Electric Railways for the taking over and enlarging of the City and South London Railway Tube and for other purposes. The only opposition was from the L.C.C., who claimed compensation in respect of the subsoil on the site of the new railways. The Committee rejected the claim.

Appointments Vacant.—Gas manager and electrical engineer for Malvern Council (£350); switchboard attendant for Torquay (30s.); chief inspector of telephones for the Government of Ceylon (£250, rising to £350, plus allowance). See our advertisement pages to-day.

Trade Announcements.—Messrs. Tetley & Co., of Falcon Works, Salford, announce that in order to centralise the commercial side of their business they have removed their offices to 6, St. Mary's Gate, Manchester, to which address all correspondence should be sent.

The Armorduct Manufacturing Co., Ltd., announce that they have purchased the goodwill and trade marks of the Sunbeam Lamp Co., Ltd., in liquidation.

Iron and Steel Institute.—The autumn meeting takes place at Brussels, from September 1st to 4th, inclusive. A preliminary list of papers has been issued. It includes: "The Electric Refining of Steel in an Induction Furnace of Special Type," by Mr. Otto Frick; "The Crystallising Properties of Electro-Deposited Iron," by Dr. J. E. Stead and Prof. H. C. H. Carpenter.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Herbert A. Fleet has resigned the position of station superintendent with the Yorkshire Electric Power Co., which he has held since 1904, when the Thornhill generating station was first put into operation.

The salary of Mr. H. A. Kell, assistant to the electrical engineer at Luton electricity works, is to be increased to £180 per annum.

The Morley T.C. has appointed Mr. Tunnicliffe as engineer-in-charge at the electricity works.

Mr. F. P. Seager has been appointed shift engineer at the Manchester city generating stations, at £175 per annum.

Mr. T. H. Heritage, station engineer at the Grantham works of the Urban Electric Supply Co., Ltd., has, on his marriage, been presented by the staff with a silver Georgian teapot.

Tramway Officials.—The Blackburn General Purposes Committee has decided to advance the salary of Mr. J. H. Cowell, the manager of the Corporation Tramways, from £400 to £500, by four annual instalments of £25 a year.

The Tramways Committee of the Rochdale Corporation recommends that the salary of Mr. George Webster, who has been appointed general manager, shall be £350 per year, rising by two annual increments of £25 to £400 per year. Staff changes which have been made include the following:—Mr. F. Ogden, to be chief clerk; Mr. Richard Bentley, to be chief traffic assistant; Mr. E. Sidgwick, to be rolling stock superintendent; and Mr. George Philipson, to be overhead equipment superintendent.

The employés of the Rochdale tramway department on July 29th presented Mr. J. S. D. Moffet, the retiring general manager, who is taking charge of the tramway undertaking at West Ham, with a silver double entrée dish and a silver hot water jug.

The Aberdeen Town Council, by 18 votes to 13, has decided to increase the salary of Mr. Pilcher, tramway manager, from £400 to £450, and thereafter by annual instalments of £25 to £500.

General.—The *Times* states that Prof. Archibald Barr, of the Regius Chair of Civil Engineering and Mechanics, Glasgow University, has intimated his resignation from October 1st.

On the occasion of his marriage, Mr. Reginald Edmund Bridle has been presented with a canteen of cutlery by Messrs. Elliott Bros., their staff and employés, and the young lady members of the staff gave his bride, Miss B. C. Relf, a silver cake basket and sugar basin.

Mr. David M. Fraser, who has for several years acted as managing director of Messrs. Walter Scott & Co. (Edin.), Ltd., has resigned his position in order to take up another appointment in London.

Mr. George Ralph has recently resigned his position as general manager of the Electric and Ordnance Accessories Co., Birmingham, and has joined the staff of the British Thomson-Houston Co., Ltd., Rugby.

Obituary.—Mr. Alfred Apps.—We regret to observe from an announcement in the *Times* "Deaths" column that Mr. Alfred Apps, late of the Strand, London, passed away on July 31st, after a few hours' illness, at the residence of his son at Calne. The deceased gentlemen, who was 74 years of age, was a member of the Institution of Electrical Engineers. We believe an announcement to the effect that Mr. Apps was relinquishing his business interests appeared some months ago. He was for very many years one of the best known London makers of scientific instruments, including electrical and X-ray apparatus. Induction-coil work wa his chief speciality.

Mr. J. S. Jeans.—We have to record the death, which occurred on Thursday last week at the age of 67 years, of Mr. James Stephen Jeans, the owner and editor-in-chief of the *Iron and Coal Trades' Review* and other papers. For some years he acted as the secretary of the Iron and Steel Institute and the British Iron Trade Association, and in the editing of proceedings and the preparation of statistics respecting the industries represented by these organisations he was an expert and experienced authority.

Prof. John Milne, F.R.S.—We learn with regret of the death, which occurred at his residence in the Isle of Wight on Wednesday last week of Prof. J. Milne, the world-renowned seismologist. In 1875, says the *Times*, he was appointed to the Chair of Geology and Mining in the Imperial College of Engineering at Tokio, where he had as colleagues Profs. Ayrton, Perry and Ewing. He returned to England in 1895, and took up his residence in the Isle of Wight, where he commenced work upon his well-known observatory. He acted for many years as secretary of the Seismological Committee of the British Association. The deceased gentleman had been ill only for a few days. He was 62 years of age.

Mr. E. A. Sandford.—The death occurred at Plymouth on July 28th of Mr. Edward A. Sandford, chief engineer to the Eastern Telegraph Co., and son of Ald. T. G. Sandford, J.P., of Gravesend. The deceased, who was only 38 years of age, had been invalided home, and he expired as the vessel in which he travelled arrived at Plymouth.

Will.—It is reported that Mr. Anthony N. Brady, the American tram, gas and electric power magnate, who died suddenly at the Carlton Hotel in London on July 22nd last, left estate estimated at $70,000,000.

NEW COMPANIES REGISTERED.

Stella Conduit Co., Ltd. (130,376).—This company was registered on July 28th, with a capital of £6,000 in £1 shares, to take over the business of conduit and tube manufacturers carried on by the Stella Conduit Co. at Bilston, and to carry on the business of manufacturers of steel and iron conduits, tube and flange makers, manufacturers of cycle and motor component parts, &c. The subscribers (with one share each) are:—R. A. Eaton, Green Lanes, Erdington, law clerk; D. J. Jordan, 68, Walford Road, Sparkbrook, Birmingham, solicitors' clerk. Private company. The number of directors is not to be less than two or more than five: the subscribers are to appoint the first. Solicitors: Shakespeare & Vernon, 83, Colmore Row, Birmingham. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Walker, Clarkson & Co., Ltd. (130,403).—This company was registered on July 29th, with a capital of £5,000 in 3,500 ordinary shares of £1 each and 2,000 founders' shares of 15s. each, to take over from E. R. T. Clarkson, F. H. Walker and the Reason Manufacturing Co., Ltd., certain patent rights, benefits and information relating to the manufacture of electric clocks, and to carry on the business of manufacturers of electric and other clocks, &c. The subscribers (with one share each) are:—E. R. T. Clarkson, 28, Lady Margaret Road, Kentish Town, N.W., tutor; F. H. Walker, 23, Lady Margaret Road, Kentish Town, N.W., machinist; H. F. Reason, Bewlah House, Southwick, Sussex, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are E. R. T. Clarkson and H. F. Reason; qualification, £50; remuneration as fixed by the company. Registered office, 25, Granville Square, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Venezuelan Telephone and Electrical Appliances Co., Ltd.—Particulars of £80,000 debentures, created July 8th, 1913, and secured by trust deeds dated July, 28th, 1890, June 17th, 1907 and July 8th, 1913, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and all property to which it was, on July 8th, 1913, entitled, together with the net revenue arising therefrom and all rights connected therewith, ranking *pari passu* with the charge in favour of the holders of the existing issue of 1st mortgage debentures, for £70,000, and entitled to the benefit of, but subject to stipulations referred to in, above-mentioned trust deeds. Trustees: National Safe Deposit Co., Ltd.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £600, on July 24th, 1913, of charge dated March 8th, 1911, securing £60,000, has been filed.

Manchester Fibrine Co., Ltd.—Deb., dated July 8th, 1913, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital (if any) subject to prior first mortgage deb. for £200. Holder: Miss E. M. Hewison, Winfield, St. George's Crescent, Pendleton, Salford.

South London Electric Supply Corporation, Ltd.—Issue on July 15th, 1913, of £2,809 debentures, part of a series of which particulars have already been filed.

Jackson Electric Stove Co., Ltd.—Debenture, dated July 23rd, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. W. Brighton, 4, Mitre Court, Temple, E.C.

CITY NOTES.

Manaos Tramways and Light Co., Ltd.

The directors' report for the year ended April 30th, 1913, shows that the tramway receipts amounted to £106,148, and the lighting to £44,148, against £109,718 and £35,603 respectively for the previous year. The result for the year is a surplus after meeting debenture interest and sinking fund, of £28,107, which compares with £16,319 for the previous year. The property has been maintained in first-class condition. During the year £21,510 has been spent on capital account, the principal items being four new cars and certain additional track work. This track work is not yet completed. The public lighting has been increased by the addition of 40 arc lamps, making 385 arc lamps. In the private lighting section 471 new customers have been secured, increasing the number of 16-C.P. lamps by 3,895, and making the total number of lamps now connected 18,960, and the monthly receipts for sale of power have increased about 100 per cent. To the balance of £28,107 is added £3,328 brought forward, making £31,435. The directors recommend that there be transferred to the contingencies reserve, making a total to the credit of this account of £15,725 (after writing off an amount of £4,275), £10,000; transferred to renewals reserve, making £21,000, £6,000; dividend on £300,000 ordinary shares at rate of £4 per cent. per annum, £12,000; carrying forward £3,435.

German Electrical Companies.

The Elektra, A.G., of Dresden, which is connected with the Schuckert group and owns, manages, or is otherwise financially interested in, supply undertakings and tramways, reports gross profits of £33,000 for 1912, as compared with £45,000 in the preceding year. After placing £3,800 to depreciation, as against £10,000, and making provision for other charges, the accounts show net profits of £18,900 as contrasted with £29,400 in 1911. It is explained in the directors' report that the profits were derived almost exclusively from current business, whereas in 1911 the accounts included large profits from the sale of securities. The dividend recommended is at the rate of 6 per cent. on share capital of £225,000, being the same rate as in 1911. The loan debt amounts to £112,500.

The Hochfrequenz-Maschinen A.G. für Drahtlose Telegraphie, of Berlin, which disposed of its patent rights (Goldschmidt) to the Compagnie Universelle de Télégraphie et de Téléphonie sans Fil of Paris for £4,000 in immediate cash payment, £60,000 in cash in two instalments payable by April, 1914, and 50,000 deferred shares in the French company, reports net profits of £46,000 for 1912 after extinguishing the deficit of £7,800 brought forward from 1911. The profits have been placed to a preliminary account until a settlement of pending transactions takes place. According to the directors' report, a site for the erection of a German station was obtained at Ellvese, near Neustadt, Hanover, and the station has almost been finished in the present year. On the other hand, the American station at Tuckerton, New Jersey, has also made progress towards completion.

The report for 1912 of the *Continentale Ges. für Elektrische Unternehmungen, of Nuremberg* states that the undertakings in which the company is interested yielded almost without exception more favourable results than in the preceding year. Among these are the suspended railway between Barmen, Elberfeld and Vohwinkel, which produced a surplus of £38,000 as against £36,000 in 1911; the Bergisch light railways and various supply works or tramways in Germany, Austria, France, Italy, &c. After allocating £16,000 to the renewal and redemption of undertakings under the company's management, the accounts indicate net profits and balance forward amounting to £99,000 as compared with £90,000 in 1911. It is proposed to pay a dividend of 5½ per cent. on the preference capital of £1,556,000 as against 5 per cent. in 1911, but the ordinary capital of £44,000 is not yet entitled to participate in the profits.—

Swiss Electrical Companies.

The Aluminium Walzwerke A.G., of Schaffhausen, after allocating £5,400 to the reserve funds, has decided to pay 7 per cent. on the preference capital of £50,000 for 1912, which is the first business year.

The Elektrizitäts Gesellschaft Baden, of Baden, in which the firm of Brown-Boveri is interested, reports net profits of £5,000 for 1912, after having applied £7,600 to depreciation, these comparing with £4,300 and £7,000 respectively in 1911. It is intended to distribute 7 per cent. on the share capital of £60,000, as against 6 per cent. in the preceding year.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, which was formed in 1898 as an investment and advance company for electrical enterprises, has a share capital of £1,000,000, and loans amounting to £947,000. The gross receipts, according to the directors' report for 1912, amounted to £104,000 from interest, dividends, and other investments as compared with £95,000 in 1911, and the net profits were £56,900 and £47,400 in the two years respectively. A dividend at the rate of 5 per cent. has been declared, this contrasting with 4½ per cent. in 1911.

The Watt. A G. für Elektrische Unternehmungen, of Glarus, which is associated with the Zurich Banks for Electrical Enterprises, reports that the undertakings in which the company is financially interested made further progress in 1912. The net receipts, which resulted entirely from interest on investments, and from commissions, amounted to £25,000, as compared with £23,000 in 1911 on a paid share capital of £280,000. It is intended to pay a dividend of 6½ per cent.—being the same rate as in 1911. The company's loan capital is precisely equal in amount to the ordinary share capital.

The gross profits realised by *Brown, Boveri & Co., of Baden*, amounted to £298,000 in 1912, as contrasted with £225,000 in the preceding year. After placing the sum of £60,000 to the reserve and depreciation funds, as against £22,000 in 1911, the balance permits of the payment of a dividend of 8 per cent. on the share capital of £1,120,000, this rate comparing with 7 per cent. in 1911. It is now proposed to seek the sanction of the shareholders to a scheme for increasing the share capital to £1,280,000 at a time which the directors may consider to be appropriate for the purpose.

The Société Electro-Métallurgique Paul Girod, of Neuchatel, earned gross profits of £27,900 in 1912, as compared with £15,000 in the previous year. After placing £11,700 to the account for depreciation, the balance has been carried forward, so that again no dividend has been paid. It has now been decided to financially reorganise the company by first reducing the share capital from £480,000 to £288,000, and then increasing the capital again to £480,000 by the emission of preference shares, the issue of which has been guaranteed by a financial syndicate.

Bristol Tramways and Carriage Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 30th.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th last at the rate of 8 per cent. per annum. This is the same rate as last year.

Traction and Power Securities Co., Ltd.—A petition for confirming the reduction of capital from £2,000,000 to £1,829,180 was presented to the Court on July 12th, and is now pending. The list of creditors is to be made out as for October 1st.

Japan.—During the month of June last the capital invested in new electrical companies in Japan was £40,000, while £235,000 was raised for the extension of existing concerns.

National Telephone Co., Ltd.—A meeting of holders of third preference shares is called for August 14th to consider the recently-delivered judgment determining the rights of holders of stock.

National Gas Engine Co., Ltd.—The directors announce an interim dividend at the rate of 5 per cent. per annum, less income-tax, on preference shares and 7½ per annum, less income-tax, on ordinary shares for the six months ended June 30th, 1913.

Spanish and General Wireless Trust, Ltd.

The directors' report for the year to June 30th last states that the issued capital is almost entirely represented by holdings of shares in the Compania Nacional de Telegrafia Sin Hilos, a company in Spain which has obtained the concession from the Spanish Government to construct and work commercially wireless telegraph stations in Spain and the Canary Islands. The development of the business of the Compania Nacional has not been as rapid as had been hoped, owing to certain difficulties which arose with some of the Spanish Government departments. Those are now in process of being adjusted, and the business should undergo important developments during the current year. Additional stations will be brought into operation in the course of a month or two which should add substantially to the company's business. In the meantime no revenue has accrued to this company from its holdings in shares in the Compania Nacional, and it is recommended that the amount of £4,654 to the credit of profit and loss account be carried forward.

Mr. Godfrey Isaacs presided at the meeting held last Friday at Marconi House, W.C. He said that the assets of the company were almost entirely composed of shares in the Compania Nacional de Telegrafia sin Hilos, and the progress of that company had not been sufficiently rapid to produce any revenue to this company in the shape of a dividend. Under the terms of the concession from the Spanish Government a number of stations had been constructed, the first of which were at Arnajuez, near Madrid, Barcelona, Soller, in the Balearic Islands, Cadiz, Vigo and Las Palmas and Teneriffe, in the Canary Islands. The business had so far been mainly that of communication with ships at sea, the receipts from which had not been up to expectations. There was already a marked improvement in the station receipts, and the number of messages month by month was increasing. Likewise the installations on board ships. The Portuguese Parliament had recently passed a law rendering wireless telegraphy obligatory on board all vessels of a certain denomination, and no doubt similar legislation would follow at an early date in Spain, which should add considerably to the business of the coast stations. During this year a new station had been opened at Santander, and others were approaching completion and should be open to service within a couple of months. Considerable difficulty had been encountered with the telegraph authorities in Madrid, which had given the directors of the Compania Nacional a great deal of trouble in connection with the International Telegraph service. Under the terms of the concession the company were clearly entitled to conduct that service, but this was questioned by the authorities. They were advised, however, that the matter had now been practically settled. It was hoped that ere long a service would be in operation between Spain and this country, a station on each side being ready to start such a service from the moment the necessary authority on this side could be obtained. Other telegraphic developments had been retarded owing to the wars in Tripoli and Morocco. When the cable broke down between Spain and the Canary Islands permission was obtained by the Spanish company to conduct the telegraph service, and for some months the whole of the telegraphic service between Spain and the Canary Islands was conducted by the Compania Nacional. When, however, the cable was repaired, the postal authorities stopped the service pending the decision as to the company's right to conduct it. The Board were given to understand that this matter had also now been satisfactorily settled and the wireless service would be permanently restarted within the next few weeks. Other business which the company had in contemplation had had to be deferred for the most part, circumstances having been unpropitious.

Mr. A. Marconi seconded, and the report was adopted.

Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd.

The adjourned second ordinary general meeting was held on Thursday last week at the Cannon Street Hotel, E.C., Mr. A. S. Collard presiding.

The Chairman explained that the meeting was adjourned last December for the purpose of awaiting the arrival in England of Mr. C. M. Bamford, who was a director and the resident engineer at Lobito. Since the last meeting Capt. Bennett-Dampier, the chairman, and two other directors had retired, in order to save expenses. He then asked Mr. Bamford to give an account of the present position of the company.

Mr. C. F. Bamford, A.M.I.C.E., said that from the inception of the company they had had a great many difficulties to contend with. One of the chief had been the abnormally wet season during the past two years, which caused the river to keep at a high level and prevented the progress of the works at the dam and power house. When he arrived at Lobito, he found that the contractors had sublet the construction of the dam and power house to local men, who had no knowledge of that class of work, and he found they were putting in bad work and not treating the native labour fairly. The contractors had some difficulty in getting rid of those men and obtaining fresh native labour after the treatment which the former natives had experienced. The shareholders were also aware that Messrs Johnson & Phillips stopped work at a most critical time—when the river was rising and when all possible labour was required to remove the plant and to protect the works. Fortunately, Messrs. Pedersen, Johnson & Brew, a most reliable firm of local contractors, came to their assistance and put their men on and saved the works. That firm had continued the construction and replaced and made good a large amount of concrete work put in by the former contractors, and had also completed the foundations for the new large sluices and a very substantial stone dam to protect the uncompleted works on the north side of the river. The time set down in the concessions for the completion of the whole of the works was very short—a period of about eight months. It had, therefore, been necessary to apply to the municipalities for an extension of time, and he was pleased to say that he had been able to arrange that. Since March last, they had supplied street lighting to Benguella and Catumbella and to Lobito, and from reports which he had received privately he had reason to believe that the public were well satisfied with the light. A number of private consumers had also had their buildings fitted with electric light, and to hasten that work the company last week sent out another wireman. The Government intended to supply electric light in their various buildings in Lobito, Benguella and Catumbella, including the Palace, Customs, Post Offices, Courts and Hospital, and they were now preparing plans and estimates for the buildings. Installations had already been commenced in some of the Government buildings, and the total requirements when completed would amount to about 16,000 c.p. Plans and estimates were also being prepared for installing the electric light in the various railway buildings, offices and workshops at Lobito. To complete a satisfactory installation in those buildings they would require about 12,000 c.p. When those installations were completed, including the municipal street lighting in the three towns, the total supply required would amount to nearly 50,000 c.p., from which a revenue of about £7,000 per annum should be derived. That represented about 1½d. per lamp of 16-c.p. per night. He thought they would agree that the price was not high for a 16-c.p. lamp to towns in Africa over 4,800 miles from England. That supply was quite apart from other consumers, namely, hotels, theatres, clubs, banks, merchants' houses, private buildings, &c. For those it was intended to charge a higher contract rate of about 2½d. per lamp of 16-c.p. per night. Before he left, the president of the municipalities approached him with regard to the company supplying power to their town waterworks. When in Lisbon, the managing director of the Sociedade Agricola de Carsequel informed him that they would be pleased to receive quotations from the company for the supply of electrical energy for their irrigation works at Catumbella. The present load there amounted to 140 h.p., and in the near future would be increased to 500 h.p. That firm was also putting down a complete new sugar plant capable of treating 250 tons of cane daily and they also intended putting down flour mills. Their property adjoined Catumbella, and the company's high-tension line passed over them for a distance of nearly 12 kilometres. Their agent reported that he could place 100 h.p. day load, which he (Mr. Bamford) understood did not include any load required by the railway company for their workshops at Lobito. He also informed them that they had been asked to transfer the Government telephone wires to their poles, for which they would pay the company an annual sum for maintenance and rent. In all probability he believed that in the near future the company would have an offer of taking over the whole telephone system in Lobito, Benguella, and Catumbella, which should be a most profitable business if worked properly.

There being no questions asked, the Chairman formally proposed the adoption of the report, which was seconded by Mr. F. S. Kerr and carried.

Subsequently meetings of the debenture stockholders were held, at which resolutions were passed authorising the directors to issue a further £7,500 in prior lien debentures.

Continental.—The French Cable Co.—The report of the Compagnie Francaise des Cables Télégraphiques of Paris states that the traffic on the Trans-Atlantic line increased during 1912, but reductions in rates for certain classes of messages had to be made in order to meet foreign competition. The bands of insurgents destroyed the line in the Antilles and a claim for an indemnity had been lodged with the Dominican Government. The cable on the line to Brazil and Guyana was frequently interrupted. The accounts show net profits of £17,400, being the same as in 1911. It is stated that as an agreement has at last been reached with the French Government a dividend of 5·90 francs gross is payable for 1912, as against 6·25 francs in the previous year.

The Russian Westinghouse Co.—The accounts of the Russian Westinghouse Co., of Moscow, for 1912, show net profits of £12,819 as compared with £12,745 in the previous year. It has been decided to pay a dividend of 3 per cent., being the same rate as in 1911. It is stated that the company has discontinued its branch at St. Petersburg.

City of London Electric Lighting Co., Ltd.—The directors announce the following dividends on account of the distribution for the year ended December 31st, 1913: On the preference shares, 6s. per share; on the ordinary shares, 6s. per share, both subject to deduction of income-tax and payable on September 15th. Last year the interim dividend was at the same rate.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share (at the rate of 5 per cent. per annum), less income tax, for the three months ended June 30th.

Jandus Arc Lamp and Electric Co., Ltd.—The directors recommend a dividend of 15 per cent., carrying forward £2,748.—*Financier.*

Montreal Light, Heat and Power Co.

The annual report to April 30th, 1913, which was submitted at the 12th annual meeting held on June 4th shows that the gross revenue was $5,509,557 and the operating and maintenance expenses were $2,328,440, with a net revenue of $3,181,116, less fixed charges $463,979, leaving a net income of $2,717,137; dividends paid absorb $1,147,500 and dividend payable May 15th, $382,500, leaving the surplus from the year's operations at $1,187,137. From this there is appropriated to depreciation renewal reserve account $550,000, and to officers' and employés' pension fund $10,000, leaving to be transferred to general surplus $627,137. The increased volume of business done by the company during the year indicates the growth of the city and suburbs and is reflected in the gross revenue. The net revenue and surplus earnings show substantial increases over last year, and the statement generally will be considered a satisfactory one. The surplus earnings $627,137, added to those from previous years, brings the accrued surplus to $3,521,243. The continuous growth of the business adds emphasis each year to the necessity of providing adequate reserve for depreciation and obsolescence of buildings and equipment, and in view of the constantly changing methods and equipment, the depreciation reserve must be ample to take care of these conditions. In the meantime this and other reserves are invested in revenue-earning plant, and the public is getting the advantage of the use of a large amount of plant upon which no dividend has to be earned. The needed extensions in the immediate future in both gas and electric departments, in order to meet the demand for service consequent upon the rapid development of the city and suburbs, will be very large, and in this connection in the gas department the company has planned a new manufacturing station of a capacity of 4,000,000 cb. ft. per diem, designed so that it can be increased to 8,000,000 cb. ft.; also an extension of coal gas plant to its present Elm station of additional capacity of 1,250,000 cb. ft. per diem. These works are now under way, and will be completed in part during the current year, and partly during next year. The new district gas-holder, now under construction in the North-West section of the city, will be ready for operation in the autumn, and when started will facilitate the distribution of gas in that section.

In the electric department the directors, during the year, entered into a long term favourable contract with the Cedars Rapids Manufacturing and Power Co., for the supply of 60,000 H.P. from their Cedars development, to be taken as and when required, and in virtue of the agreement it is incumbent upon this company to transmit the power to Montreal. For this purpose a steel tower transmission line will be constructed, and the work, which is already in hand, will be completed simultaneously with the Cedars development. Consequent upon the acquisition of additional hydraulic power from the Cedars Rapids Co. as intimated, and with a view to maintaining a definite ratio between steam reserve and hydraulic power, the company has planned a new central auxiliary steam station of a capacity of 25,000 H.P. (with provision for an ultimate capacity of 50,000 H.P.) to safeguard the company and its customers against possible interruptions and variations affecting its hydraulic supply. This station it is expected will be ready for operation in October of the present year. To afford its customers better convenience, and to facilitate the handling of the company's business, the directors acquired additional land adjoining the present power building, and have arranged for the construction of a ten-story annexe for office purposes. The construction of same is at present under way, and it is expected will be completed for occupation May 1st, 1914. There will also be the usual large extensions necessary to both the gas and electric distributing systems to meet the constantly increasing demand for service in the newer sections of the city and suburbs.

In view of the extensive works and additions under way and in contemplation, it will be necessary to raise new capital, and the directors have passed a by-law authorising an increase in the capital stock of $5,000,000. Only a proportion of the additional capital will be required for the time being.

The directors have just announced a further reduction in gas and electric rates, effective from July, 1913, meter readings. The concession in the gas rate is equal to over 5 per cent., and in the rate for incandescent electric over 9 per cent. It is expected, as heretofore, that additional business will compensate the resultant loss in revenue. The properties and plants of the company and its various subsidiary companies have been maintained in the same high state of efficiency as heretofore, as evidence of which there was expended during the year on maintenance account, $138,367, which, with the appropriation for depreciation renewal reserve as noted, represents a total expenditure and provision in this connection of upwards of $988,368.

Kalgoorlie Electric Tramways, Ltd.

The directors' report for the year ended December 31st, 1912, shows that the gross receipts amounted to £37,917 against £41,472 for the previous year, while the net profits earned were £10,099 as compared with £14,250 for 1911. The directors regret to have to report the continued decrease in traffic receipts, owing to a continuance of the depressed conditions of business which have unfortunately existed in Kalgoorlie for some years. Although many of the large mines are showing good developments at depth, which must add considerably to the life of the mines in question, yet these discoveries have had no immediate effect on the prosperity of the district. The report contains a comparative statement from the company's attorney showing the decrease in the output of gold from the mines, the decrease in the number of men employed and the decrease in profits per ton. The general labour agitation which has prevailed at Kalgoorlie is also a factor against the earning capacity of the tramway. During the current year the company has had to defend itself in the Arbitration Court against an action by its workmen for improved wages and conditions; the actual award is not yet known, but it is anticipated that it will, when given, be an increased burden on the company. The board regret that they were compelled to suspend the payment of interest on the "B" debenture stock since June 30th, 1912. The engineer reports as follows:—

Operation.—During the year the cars travelled 619,170 miles as against 621,086 car-miles in 1911, and carried 2,489,833 passengers as against 2,694,936 in 1911. The earnings per car-mile in 1912 were 14·65d. as against 15·98d. in 1911, with an expense of 10·07d. per car-mile in 1912 as against 9·97d. in 1911. The expenses per cent. of earnings in 1912 were 68·74 as against 62 39 per cent. in 1911.

Power Supply.—The number of units charged by the Power Co. in 1912 was 703,189 (£8,057 18s. 11d.) as against 642,292 (£7,163 7s. 1d.) in 1911.

Rolling Stock and Equipment.—With due regard to efficiency and economy, the whole of the company's rolling stock, plant, tracks and overhead lines have been well maintained during the year.

A further amount of £6,191 of "A" debenture stock has been redeemed in respect of the year under review, and during the current year an additional sum of £6,598 has also been bought for redemption, thus reducing the stock outstanding to £56,780. The board record their appreciation of the work done by the staff in Western Australia during the year, and especially to Mr. Stanley for the way in which he has conducted the case on behalf of the company before the Arbitration Court, for the extra work done, and for the manner in which he has surmounted many difficulties.

The ninth annual meeting was held on Friday last at the London Chamber of Commerce, Cannon Street, E.C., Mr. Allen H. P. Stoneham presiding.

In proposing the adoption of the above report, the Chairman said he was sorry to say that the accounts were not so satisfactory as they could wish, owing, in a great measure, to the depressed state of business in Kalgoorlie and the fewer men employed in the mines. Alongside that they had to face the fact that the company's employés were receiving higher wages than was the case a few years ago, and although the traffic receipts had decreased, the expenses had gone up. Their manager, Mr. Stanley, did all he could to keep the expenses down, and he had had a very arduous time this last year, as the arbitration with the men had been a very hard proposition to deal with. They had to combat the men at every point, and Mr. Stanley made a most strenuous fight; being complimented both by his opponents and the judge on the fight he put up. In addition to their other troubles, they had had to contend with meter troubles. As the shareholders were aware, they obtained their current for working the tramway from the Kalgoorlie Power Co., and it was paid for on a meter rent. They had always had two meters—one to check each other, and for some years the meters agreed. Some five months ago there was a tremendous storm in Kalgoorlie, which damaged their posts and blew down part of the power works, and the meters began jumping about in an extraordinary way, and they had never agreed since. They would not have minded if they had registered less, but, unfortunately, they registered more—alarmingly more. They had called in various experts to calibrate the meters and overhaul them, and at last they had got them to agree within a very small fraction, and he believed that from now their consumption of electricity would be considerably less costly than it had been. He believed that for some months past the meters had been reading wrongly to the detriment of the company, with the result that they had been paying a good deal more for electricity than they ought to. They still had a dispute with the power company as to £300 or £400, which they had gone to arbitration upon. Their traffics had been affected, because not only were there between 4,000 and 5,000 fewer men working in the mines, but there was now a much larger proportion of single men employed there. They had great hopes that the commencement of the Trans-Continental Railway would have helped them materially. That work had been begun, but in a very half-hearted fashion, and, so far, it had not benefited Kalgoorlie. He hoped that the wave for nationalising nearly everything in Australia would reach Kalgoorlie, and that the Government would purchase their tramways, as they had those of Perth. There had been *pourparlers* on the matter, but nothing definite had come from them. The shareholders might be sure that if the board got a decent offer they would recommend it to them for their acceptance.

Mr. C. C. Baker seconded the motion.

Replying to questions, the Chairman said the board were quite alive to the desirability of reducing expenses wherever possible. As to reducing their fees, he would point out that some two years ago the directors' fees were considerably reduced, and there was much more anxiety and work in managing a company that was not paying than there was in looking after a flourishing concern.

The report was adopted.

Perth Electric Tramways, Ltd.—At an extraordinary general meeting held on Friday last, the resolution already passed for winding up the company, was confirmed. Messrs. C. Wren and F. Holyfield, of 30 and 31, St. Swithin's Lane, E.C., were appointed liquidators. The chairman, Mr. O. Wethered, said that there was an excellent prospect of a distribution of £1 a share being made within 10 or 14 days.

Mather and Platt, Ltd.—According to the *Times*, an interim dividend on the ordinary shares of 5 per cent., free of tax, for the half-year ended June 30th, being at the rate of 10 per cent. per annum, is announced.

Anglo-Bohemian Industry, Ltd.

At the statutory meeting of the Anglo-Bohemian Industry, Ltd., held on July 14th in London, Lord Teynham said (according to a report supplied to the *Financial News*) the company's chief occupation had been to make ready for the construction of the plant which was to supply the South Bohemian towns and districts and industries with electrical energy. Some 37 towns and districts have formed a confederation for the purpose of taking their supply of electrical energy from the company's works at Netolitz, and a committee had been appointed to deal with the matter, consisting of the mayor of the royal town of Pisek, several Members of Parliament, district deputies, large landowners, and members of the Board of Trade of Prague, Pilsen and other places. The technical preparatory work would be done without further delay by the Government Board of Bohemia. When the scheme was complete, this company would possess a valuable monopoly, as no power station would be admitted in South Bohemia, except the one belonging to this company at Netolitz. The County Council of Bohemia had worked out a general project for the supply of electricity to the various districts in the whole country. In each district only one monopoly was to be given for the supply of electricity. The connection and division of the various towns and localities were in the hands of the County Council, but works might be constructed by third parties under a guarantee as to capital, interest, and amortisation. The contract for the supply of electricity by the Anglo-Bohemian Industry, Ltd., had been granted by the South Bohemian districts, and preliminary contracts had been signed by the County Council, and had now only to be formally confirmed by the Government, which confirmation would be given before the end of the month. In addition to the towns and districts mentioned, important negotiations had been opened with industrial concerns, including large paper mills and a brewery at Budweis, and a preliminary contract had been concluded with his Excellency Prince Schwarzenberg, by which his breweries and other industries and properties had agreed to take and pay for at least 400 KW. and 2,000,000 KW.-hours per year at a minimum price of 120 kronen per KW., and 7 heller for each KW.-hour. The construction of the electric power stations had been decided upon by three installations, and in consequence the estimates made for the working expense had been made on the basis of each separate construction respectively on each increase of the plant. The first construction would be finished within 15 months, the second during 1916, and the third in 1918. The managing director estimated the net profits from the contracts already entered into at about £30,000.

New Companies in 1913.—The *Investors' Guardian* in the course of its summary of company registrations for the first half of 1913, says: "Notwithstanding the decrease of 18 millions in the aggregate capitalisation of the companies registered during the last six months, there are some notable individual exceptions. In the capitalisation of electrical companies, £4,498,787, there is a gain of about £2,800,000; in chemical and medical, £3,398,122, a gain of £2,500,000, to which the Nitrogen Products and Carbide Co. contributes £2,000,000; in textile manufacturing, £5,945,850, a gain of £2,000,000, more than accounted for by the huge Courtauld registration of £2,500,000; in railways and tramways, £2 459,007, a gain of £1,300,000; in coal and fuel, £3,969,508, an increase of £1,200,000, more than accounted for by the Consolidated Cambrian registration of £2,000,000. The motor, cycle, 'bus and car figures, £4,783,460, an increase of £800,000, proclaims the activity and wide diffusion of the motor-'bus and of the motor-car. Pottery and earthenware, £1,035,330, compare favourably with £225,500; theatres and amusements, £2,561,824, as against £1,279,750, testify largely to the great vogue of the cinematograph, and the formation of the numerous companies for its display. The water registrations are £541,000, as against £208,500. Amongst the principal decreases are finance registrations, from £9,987,437 to £6,281,860 and timber, from £2,547,753 to £988,404."

Northampton Electric Light and Power Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum (6d. per share), less income-tax, on the ordinary shares for the half-year ended June 30th.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange returned from its Bank Holiday week-end in a cheerful frame of mind. Parenthetically, and more literally, it ought to be said that about half the Stock Exchange returned, the other half keeping holiday, which the cynical declare means losing less money than is involved in coming to town. The general outlook, however, is not at all bad.

One of the most healthy signs to be discerned at present is the steady way in which industrial stocks and shares of all kinds are moving up. Advances have occurred since we last wrote in such sections as those for Iron and Steel shares, Electric Lighting issues, Telegraph and Telephone descriptions, Brewery stocks, and the like. Notwithstanding the holiday atmosphere, the investor is certainly more willing at the present time to utilise his money in stocks and shares than has been the case for some time past; and a quiet improvement in the price of Consols came as a useful stimulus to markets as a whole.

The batch of dividends declared by the Home Railway Companies must be considered quite satisfactory, and the early disappointment caused by the first declarations has been wiped out by subsequent results. No doubt the Home Railway market would have responded with greater alacrity than it has done, were it not for the absence of the half-yearly statements and meetings, reference to which has already been made in these columns. People are averse from buying stocks and shares in companies, the progress of which is only to be made public—except through the medium of weekly traffic returns—once a year. Barring labour troubles, however, there ought to be a good time in store for the Home Railways through the next six months; and towards the end of the autumn it is conceivable enough that there may be a boomlet on the strength of the anticipated dividends for the full year.

Metropolitans, *ex* their little dividend of 15s., are practically unaltered at 45. In the Central London group the Ordinary and Preferred, both non-assented, were quoted *ex* dividend, allowing for which there is virtually no change in quotations. Districts remain about 33, but Underground Electrics are ⅜ better as regards the £10 shares. The shilling shares have begun to harden, and both Debentures show rises. A feature of the week has been a recovery of five points in London United Tramways 4 per cent. Debenture, restoring the quotation to 61, and so wiping out most of the loss sustained in July. London and Suburban Ordinary and Preference shares, however, have both given way, the price being 7s. 6d. and 12s. 6d. respectively; while the Debenture stock remains at the very wide price of 65-75.

Dividend declarations in the English Electricity Supply group are having a good effect upon the prices, though it is only in the case of the County of London that any change has been made from the usual interim rates. County Ordinary further improved to 11, Westminsters and Metropolitans are both ⅛ higher, and the market holds more strength than may seem apparent, from the fact that other prices are virtually unaltered. The Brush Company has issued one of its usual melancholy reports, showing a fresh loss of £7,700, which has to be added to the already enormous amount to the debit of the undertaking, making altogether £243,000. Negotiations are in progress now to put the finances of the company on a sounder basis, but no further steps are likely to be taken till the accounts for the present year are complete. It is stated that the contracts in hand are at satisfactory prices. Until drastic measures have been taken to secure the reorganisation of the capital account, it is well-nigh hopeless to expect the concern to make any real headway in the direction of earning profits for its unfortunate proprietors.

Other changes in the list of Manufacturing shares are mostly in the upward direction. Castner-Kellners hardened to 3⅛. India-Rubber shares rose to 12. There is a steady enquiry for the Debenture stocks of most of the leading companies.

The market in Telegraph and Telephone descriptions is distinctly a good one. In most of the various groups there are improvements. Amongst Anglo-Americans, Direct United States are better at 7, these being ¼ up, in addition to the dividend of 2s. deducted last week. Anglo-American Preferred retains its rise, but the Deferred stock at 23⅝ is ½ lower. The Eastern group have been helped by the continuance of satisfactory news with regard to China. Eastern 4 per cent. Debenture rose to 94, the Preference has gained 1½. Eastern Extension Debenture at 93 *ex* dividend has recovered its interest. No further change is to be noted in West India and Panama shares. In sympathy with the good tone of the market, Globe Telegraph Ordinary rose to 11. New York Telephone 4½ per cent. Debentures have once more touched par. National Telephone Deferred, quoted *ex* £22 return of capital, is now about 6½, and it is thought in the Stock Exchange that the final distribution, which will wind up the whole business, may be forthcoming somewhere about the end of October. So far, £97 per cent. has been returned to stockholders; and it is not surprising that those who remain of the original body hold emphatic views with regard to the suitability of the nation taking over the interests of joint stock companies, whatever may be the monopoly which the latter enjoy.

Marconis spurted ⅝ for the Ordinary, and ¼ in the case of the Preference, on the dividend expectations. The terms of the company's proposed new contract with the Government have had no influence upon the price of the shares. American Marconis hardened to 17s. 6d.; the Canadians remain about 8s. 6d.

Once again there is a disposition to regard more favourably the various companies in Mexico, and this was reflected in advances amongst the Utility Companies' issues as well as those of the Railways. The principal rises have been secured by the Common shares of the Mexico Tramways and the Mexico Light and Power, but there are also smaller improvements in the bonds of this group. Brazilian Tractions rose 3, to 88 *ex* dividend, and the progress which is being made by this Company is well spoken of. Anglo-Argentine Debentures are harder. Victoria Falls Preference remain at 15s. It is generally conceded that the trouble on the Witwatersrand may be considered at an end, save for minor points awaiting settlement.

The market for copper, the metal, continues to soar, fresh rises being registered almost every day. In consequence, the shares of most of the copper-mining companies are decidedly good. Rubber, too, shows a slight inclination to recover from its low price, optimistic statements at two recent meetings helping to allay apprehension in the share market, where prices are a little harder. It may be noticed, in passing, that in spite of all the invitations advanced to them to come into the open with expressions of their views, the rubber-users, up to the present, have been very retiring and reticent, which, in the circumstances, is just what might have been expected.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 5th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9¾ — 10¾	..	5 14 3
Do. 4½ % Pref.	10	4½	4½	8½ — 9⅜	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10¾ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96	..	4 13 9
Brompton & Kensington, Ord...	5	10	10	8⅝ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅜	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4¼ — 4⅜	..	5 5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4	..	5 12 6
Do. Do. 4 % Deb... ..	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	14½ — 16	..	5 12 6
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	98 —100	..	4 10 0
County of London, Ord... ..	10	6	6	10⅞ — 11⅛	+ ⅛	5 6 8
Do. 6 % Pref.	10	6	6	11⅛ — 11⅜	+ ⅛	5 1 1
Do. 4½ % Deb.	Stock	4½	4½	102 —104	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ½	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	— ⅛	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	88 — 90 xd	..	5 0 0
Hove	5	9	9†	7⅞ — 8½	..	5 9 1
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7⅞	..	5 16 2
Do. 4 % Deb.	Stock	4	4	88 — 91 xd	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	8	2½	2½	1½ — 1⅝	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	3½ — 3⅝	+ ⅛	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	6†	5⅞ — 6⅛	..	5 18 9
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 8¾ xd	..	5 14 3
Do. 7 % Pref.	5	7	7	6½ — 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5	5½	2¾ — 3⅛	— ⅛	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref...	1	7	7	1⅞ — 1⅞	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord...	£3	Nil	Nil	½ — ⅝	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8¾ — 8⅞	+ ⅛	5 15 11
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5⅛	..	5 14 3
Calcutta, Ord.	5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90 — 92	—1	5 8 8
Canadian Gen. El. Com. ..	$100	7	7	108 —112	+1	6 5 0
Do. 7 % Pref.	$100	7	7	118 —123	..	5 18 10
Cordoba Lt., Power and T., Ord.	1	3	5	⅝ — ¾	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/32	..	Nil
Do. 6 % Pref.	1	6	6	11/16 — ⅝	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100 —102	+ ⅛	4 18 0
Madras, Ord.	5	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	60 — 64	+⅜	6 5 0
Do. 7 % Cum. Pref.	$100	7	7	92 — 97	..	7 4 4
Rio, 5 % 1st Mort. Gold Bds.	..	5	5	85 — 88 xd	+1½	5 13 8
Do. 5 % 2nd Mort. Bonds ..	100	5	5	74 — 77	..	6 9 10
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power ..	$100	8	9†	207 —217 xd	..	4 2 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	124 —128	..	4 5 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99 —102	..	4 8 8
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	11¾d.	17¾d.	11/16 — 12/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 96½	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	130 —133	..	6 0 4
Do. Collat. Trust	$1000	4	4	90½ — 92½	..	4 6 6
Anglo-American Telegraph ..	Stock	5	5	60 — 63 xd	..	4 15 3
Do. 6 % Pref.	Do.	6	6	108 —109	..	5 10 1
Do. Def.	Do.	80/-	80/-	28⅛ — 28⅝	— ⅛	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 3
Chili Telephone	5	7	8	7.5/16 — 7.7/16 xd	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83½ — 84½	..	4 14 8
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15½ — 16½	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 5 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7⅛	..	6 12 0
Direct United States Cable ..	10	5	4	6½ — 7½ xd	+ ½	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	+1	5 7 8
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	75½ — 77½	+1½	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	93 — 95	+1	4 4 3
Eastern Extension	10	7	7	12 — 12½	..	5 10 2
Do. 4 % Deb.	Stock	4	4	92 — 94 xd	+2	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	10⅞ — 11½	+ ⅛	5 6 8
Do. 6 % Pref.	10	6	6	11½ — 12⅜	+ ⅛	4 17 0
Great Northern Telegraph ..	10	18	20	29½ — 31½	..	6 7 10
Indo-European Telegraph ..	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	79 — 81	..	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3.9/16 — 3.11/16	+ 1/16	5 8 6
Do. 7½ Cum. Partic. Pref.	1	17	..	2⅛ — 2⅜	+ ⅛	5 8 9
Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99 —100	+ ½	4 10 0
Oriental Telep. and Elec. ..	1	8	10	1.13/16 — 1.15/16	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅛	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10	8⅜ — 9⅜	..	10 5 2
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	3	3†	6⅛ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1.3/16 — 1.5/16	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2.5/16 — 2.7/16	..	4 17 6
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅛ — 10⅛	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 9⅞	..	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12⅜ — 13½	+ ⅛	5 6 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 5th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	5/16 — 7/16	..	Nil
Do. 5 % Pref.	1	5	5	5/8 — 3/4	..	6 13 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	8 — 10	..	..
Do. Do. Deferred	100	..	..	3¼ — 5¼	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	37 — 40	—1	7 10 0
Do. 5 % Perp. Deb.	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	72 — 76	—1	5 18 5
Central London Railway, Ord.	100	3	3	73 — 75 xd	..	4 0 0
Do. Gtd. Assented	100	..	..	80 — 82	..	4 18 9
Do. Pref.	100	4	4	73 — 80 xd	..	5 0 0
Do. Gtd. Assented	100	..	..	82 — 84	..	4 15 8
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99 xd	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	99 —101 xd	..	4 19 0
Do. Do. 1896	100	5	5	98 —100 xd	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99 xd	..	5 1 0
Do. Do. 1903	100	5	5	96 — 98 xd	..	5 2 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2¼ — 2⅝	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	1/32 — 3/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	63 — 73	..	6 3 3
sle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	1/32 — 3/32	—1/32	..
Do. Do. 5 % Cum. Pref.	1	..	..	1/16 — 1/8	—1/32	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 5th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	89 — 93	+5	6 7 0
Metropolitan Railway Consol.	100	1⅛	1⅛	44⅜ — 45½ xd	+ ½	3 11 10
Do. Surplus Lands	100	2⅜	2⅜	59 — 61 xd	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 86 xd	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	81 — 83 xd	..	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79 xd	..	4 8 7
Metropolitan District Ord.	100	Nil	Nil	33 — 33½	+ ½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	81 — 83 xd	..	5 8 3
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	3½	3/32 — 5/32	..	..
Do. 5 % Pref.	1	5	5	1/16 — 1/8	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	1/8 — 3/32	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	8¾ — 9	+ ⅛	Nil
Do. "A"	1/-	4½	..	3/32 — 1/8	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	110 —113	+1	5 7 2
Do. 4½ % Bonds	100	Nil	4½	98 —100	..	4 10 0
Do. 6 % Income	100	3	6 †	91 — 92	— 1	6 10 5
Yorkshire (West Riding), Ord.	5	..	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	..	3†	3½ — 4	+1/16	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4⅜ — 5	..	5 10 0
Do. 2nd Pref.	5	5⅛	5⅛	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	91 — 93	+ ½	4 6 0
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	97 — 99	+ ½	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	100 —102	+1	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	87 —89 xd	+3	6 14 10
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅛	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	123 —128	..	6 5 0
Do. Pref. Ord.	100	6	6	109 —114 xd	..	5 5 3
Do. 5 % Pref.	100	5	5	102½ —105½ xd	..	4 14 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102 xd	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7	5†	5⅜ — 6⅛	+ ⅛	5 12 0
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1/16 — 1/8	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5 1/16 — 5 1/8	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 35	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	1/32 — 1/16	..	..
Do. Pref.	1	6	..	3/8 — 1/2	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1/32 — 1/16	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4⅜ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	86½ — 89½	..	5 11 9
Manila Elec. R. and Lt., Bonds	$1000	5	5	99 — 101	..	4 19 0
Mexico Trams Com.	$100	7	7†	89 — 92	+3	7 12 2
Do. Gen. Con. 5 % Bonds	..	5	5	87 — 90	..	5 11 1
Do. 6 % Bonds	100	6	6	86 — 89	+1	6 14 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	6 — 6⅛	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99 —100	+ ½	4 19 0
Do. 5 % Mort. Bonds	100	5	5	93 — 95	+1	5 5 6
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	100 — 102	— ½	4 18 0
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	94½ — 96½ xd	..	5 3 8
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4¾	..	7 3 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅜	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	3/32 — 1/8	..	7 7 8
Do. 6 % Pref.	1	6	6	3/32 — 1/8	..	7 2 6
Babcock & Wilcox	1	28	16	2¾ — 3	—1/32	5 6 8
Do. Pref.	1	6	6	1⅛ — 1⅜	..	4 7 3
British Aluminium, Ord.	1	Nil	..	3/4 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	3/4 — 7/8	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	82 — 85	+1	5 17 8
B.I. & Helsby Cables	5	10	10	7⅞ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅛ xd	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	1/2 — 17/32	..	Nil
Do. Deb.	100	4	4	62 — 66	..	6 1 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Brownett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	88 — 48	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10⅜ — 11⅜	..	6 11 10
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	31½ — 33/4	+ ⅛	5 4 11
Do. Deb.	100	4½	4½	102 —105 xd	+1	4 5 9

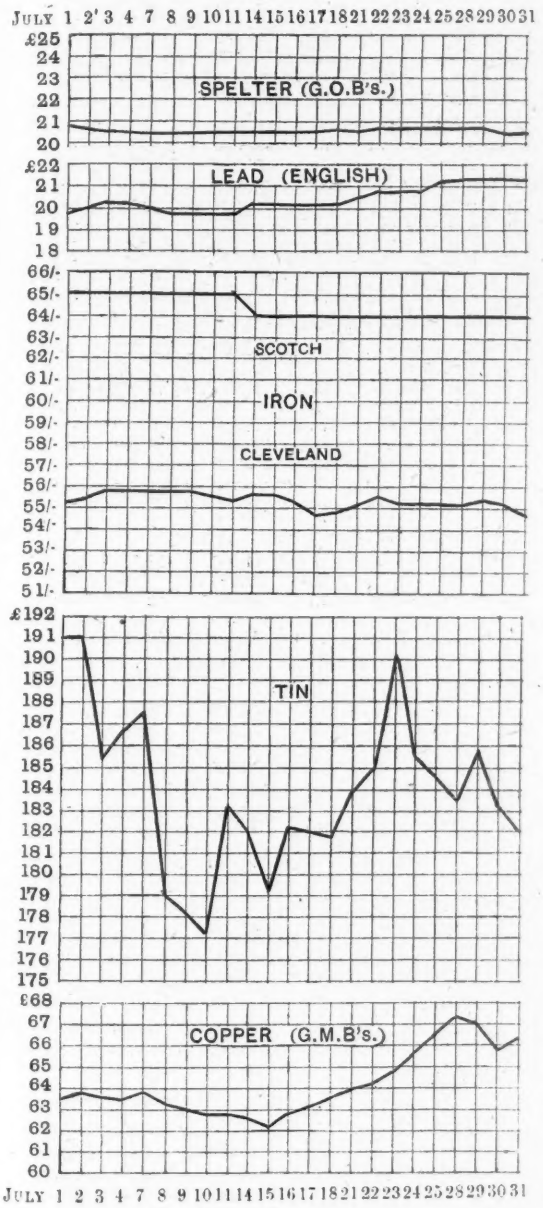
Crompton & Co., Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	3/32 — 5/32	..	..
Do. Pref.	1	6	6	3/4 — 7/8	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3½	5	1 — 1¼ xd	..	8 0 0
Do. Pref.	2	7	7	1 13/16 — 2 1/16 xd	..	6 15 9
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 9
General Electric, 6% Pref.	10	5	6	9½ — 10½	..	5 14 3
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12 — 12⅝	..	5 17 8
Do. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	..	7½	11½ — 12½	+ ½	6 0 0
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37	..	6 7 2
Do. Deb.	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/32 — 3/32	..	Nil
Do. Pref.	5	Nil	..	1/8 — 1/4	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

METAL MARKET.

Fluctuations in July.



Copper.—Contrary to what would be expected from the tone of the market, visible supplies (European) for the end of July have maintained their figure, and even appreciated a little. According to Messrs. Merton's statistical circular, the stock in England and France and afloat thereto from Chile and Australia for the end of July was 28,344 tons, an increase of 202 tons over the quantity for the end of June, which goes to make up the 273 tons increase in French stocks. English stocks are down by 1,196 tons. Total European stocks decreased by 2,569 tons, the most marked withdrawal being from Hamburg, 1,857 tons. Arrivals from North America were high, from Spain and Portugal just under average, from Chile an unusually large consignment, and from Australia a quantity above the average, *i.e.*, 4,600 tons, to an average for the last 12 months of 3,845 tons. Total deliveries were 51,854 tons, a quantity which has not been equalled, except in May last, since February, 1912. Stock in American producer's hands, as published by the American Producers' Association, was, for the end of June, 23,578 tons, a reduction of 6,544 tons during May. The world's visible supply at the end of June was 61,774 tons, which is getting distinctly low.

The G.P.O. and Electric Vehicles.—We hear that the G.P.O. are carrying out some trials in the Bristol district with electric motor vehicles fitted with Edison batteries, for the delivery of the mails.

TIMING WATT-HOUR METERS.

In order that the accuracy of a motor watt-hour meter may be deduced by comparing the watt-hours represented by a certain number of disk revolutions with the indications of power measuring instruments and the meter speed, it is necessary that the latter quantity be determined, in precision work, to at least 0·1 per cent. accuracy.

Hitherto stop-watches have usually been employed in timing meters. The errors to which these watches are subject are large and variable, and to attain the desired degree of accuracy it has been necessary to average the results of a number of observations taken over, say, two-minute periods, in order to arrive at a single test figure. Allowing for the possibilities of inaccurate meshing, throwing of the second hand, time error in the watch's movement and the personal error of the observer, it is unsafe to rely upon higher than 0·2 per cent. accuracy when stop-watches are used.

The large amount of code testing of meters carried out at the New York Electrical Testing Laboratories has led to the evolution of more accurate methods of meter timing. In the first place, an ordinary chronograph was substituted for the stop-watch—two series of records being made on the tape by a standard clock beating seconds and by the observer pressing a key at every revolution of the meter disk. An accurate measurement of time was thus secured, but personal error still remained, and to avoid this, the meter was made to record its speed automatically. Messrs. Seaman & Currier devised a method in which contact was made between two platinum

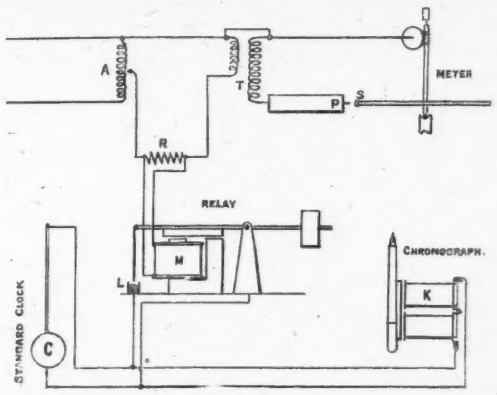


Fig. 1.

tipped wires, or between a platinum wire and a mercury cup, at each revolution of the meter; the times of contact were recorded on an "errometer" (a specially designed chronograph with six pens). Contacts of this type are not, however, permanently reliable, and a new method of attaching them must be devised for each new type of meter tested.

A modified system* has, therefore, been in use since September, 1912, in which a high-voltage spark passes from a stationary point to a point on the meter rotor at each revolution of the latter, and, by its passage, operates a relay controlling the chronograph pen. The high voltage for the spark is provided by a 10,000-volt testing transformer (T, fig. 1). A limiting resistance R is placed in series with the primary, and the supply pressure is regulated by the auto-transformer A. Connections are made as shown; in rotating standards the large pointer forms the moving contact, and the stationary point is a piece of wire held below the glass cover near the dial. In the ordinary house service meter, a 10-milligramme wire is sprung on to the disk to form the moving point S.

When S passes P, a discharge occurs which practically "shorts" the transformer secondary. The rush of primary current increases the voltage across R, and thus operates the relay M (the moving system of which is heavy, gravity-controlled and damped by a spring). The chronograph magnet circuit is thus closed at each revolution of the meter disk, and a standard clock C sends second-signals which are recorded by the same pen.

The insulation of the meter coils is not subjected to a higher P.D. than 120 volts, and the tester can only receive a shock (and then not a dangerous one, since the secondary current is limited to 0·008 ampere), by deliberately touching the H.T. needle point, which is encased in a high insulation tube. A liquid contact in the chronograph circuit gives a record of nearly constant length at all meter disk speeds. The instrument actually employed in the Electrical Testing Laboratories has two pens on a rolling carriage, which is moved the length of a recording drum by a screw thread. The drum speed is governed and is set to give one revolution in 30 sec.; a 1 sec. interval is then represented by two dots ½ in. apart and 0·05 sec. can be easily read by aid of 10 radial lines etched on a microscope cover glass. Red and black inks are used in the two pens, so that two meters can be safely tested at once.

The chronograph charts are worked-up by selecting a meter-mark near the beginning of the record as the revolution-zero and the preceding second-mark as the time-zero. A line is drawn through the second-marks in the same vertical row, inclined lines are drawn through the meter-marks on adjacent rows, and from the time for a

* Described by G. Thompson in the *Electrical World*.

given number of revolutions, the disk speed is computed and the meter accuracy determined in the usual way. The charts can be preserved for any future reference, and since the final accuracy depends only on the precision with which the load is controlled, it is easy to keep well within 0·1 per cent. error.

It is possible that the recording spark may not always jump the gap S P when these points are in the same relative position. Variation in the latter seldom exceeds $\frac{1}{32}$ in.—corresponding to 0·3 per cent. error in one revolution of a 3½-in. disk. If three normal sparks follow one maximum "overleap," the error would be reduced to 0·1 per cent., but, as a rule, the "overleap" is more or less uniform in successive revolutions, and the error, therefore, smaller. The electrostatic field between the meter disk and the fixed sparking electrode is appreciably changed only during the moment in which the moving point sweeps past P (fig. 1), and tests on a "creeping" rotating standard needle, under much less favourable conditions, showed no appreciable change in speed before, after or during the spark. When testing meters in which the field windings are on the front side of the spindle, it is conceivable that the spark current traversing the disk between the poles might exert a torque effecting the rotation of the moving element, but experience shows that this error is negligible, and can, in any case, be eliminated by using test and spark currents of different frequencies.

The new method of meter testing requires only one observer, whose sole duty is to maintain constant load, and a number of meters can be tested at once and in a shorter length of time than is required by the stop-watch method. Using a two-pen chronograph, 20 meters can be timed at one load in 25 minutes (as compared with not less than 40 minutes, employing the stop-watch method and four testers—three of whom would be engaged in meter timing). Where a few meters are to be subjected to a number of tests (for research or other purposes), the saving in time by the application of the new method is very important.—S. M. Powell.

TRADE STATISTICS OF ITALY.

The following figures, showing the imports of electrical and similar goods into Italy during the year 1911, have been taken from the recently issued official trade statistics; the figures for 1910 have been added for purposes of comparison, and notes of increases or decreases are given; the preponderance of German trade and the comparative insignificance of British in most lines will be immediately apparent:—

	1910. Lire.	1911. Lire.	*Inc. or dec.* Lire.
Copper, brass or bronze wire more than ½ mm. diameter.—			
From France	1,372,000	1,455,000	+ 83,000
„ Germany	1,517,000	1,280,000	— 237,000
„ Great Britain ...	125,000	5,000	— 120,000
„ Other countries ...	112,000	173,000	+ 61,000
Total ...	3,126,000	2,913,000	— 213,000
Copper, brass or bronze wire of ½ mm. diameter or less.—			
From Germany	338,000	422,000	+ 84,000
„ France	34,000	34,000	—
„ Other countries ...	4,000	10,000	+ 6,000
Total ...	376,000	466,000	+ 90,000
Boilers.—			
From France	155,000	330,000	+ 175,000
„ Germany	717,000	487,000	— 230,000
„ Great Britain ...	1,715,000	1,803,000	+ 88,000
„ Switzerland ...	139,000	65,000	— 74,000
„ Other countries ...	306,000	255,000	— 51,000
Total ...	3,032,000	2,940,000	— 92,000
Steam engines, fixed without boilers.—			
From Belgium	7,000	15,000	+ 8,000
„ Germany	306,000	504,000	+ 198,000
„ Great Britain ...	1,100,000	1,033,000	— 67,000
„ Switzerland ...	262,000	22,000	— 240,000
„ United States ...	169,000	365,000	+ 196,000
„ Other countries ...	137,000	275,000	+ 138,000
Total ...	1,981,000	2,214,000	+ 233,000
Steam engines, semi-fixed (with boilers), hot-air motors, compressed air, gas, petrol, &c.—			
From France	110,000	145,000	+ 35,000
„ Germany	1,505,000	1,781,000	+ 276,000
„ Great Britain ...	1,590,000	1,608,000	+ 18,000
„ Switzerland ...	599,000	474,000	— 125,000
„ United States ...	231,000	291,000	+ 60,000
„ Other countries ...	376,000	516,000	+ 140,000
Total ...	4,411,000	4,815,000	+ 404,000
Hydraulic machines and water or wind motors.—			
From France	102,000	83,000	— 19,000
„ Germany	1,035,000	1,228,000	+ 193,000
„ Great Britain ...	962,000	555,000	— 407,000
„ Switzerland ...	360,000	168,000	— 192,000
„ Other countries ...	158,000	168,000	+ 10,000
Total ...	2,617,000	2,202,000	— 415,000
Dynamo-electric machines weighing more than 1,000 kg.—			
From Austria	159,000	174,000	+ 15,000
„ France	236,000	749,000	+ 513,000
„ Germany	4,911,000	4,860,000	— 51,000
„ Great Britain ...	945,000	438,000	— 507,000
„ Switzerland ...	1,458,000	353,000	—1,105,000
„ United States ...	64,000	88,000	+ 24,000
„ Other countries ...	236,000	306,000	+ 70,000
Total ...	8,009,000	6,968,000	—1,041,000
Ditto, weighing 1,000 kg. or less.—			
From Austria	106,000	264,000	+ 158,000
„ France	160,000	208,000	+ 48,000
„ Germany	4,685,000	4,365,000	— 320,000
„ Great Britain ...	401,000	294,000	— 107,000
„ Switzerland ...	630,000	306,000	— 324,000
„ United States ...	489,000	195,000	— 294,000
„ Other countries ...	138,000	287,000	+ 149,000
Total ...	6,609,000	5,919,000	— 690,000
Accumulators and metal parts.—			
From Germany	15,000	28,000	+ 13,000
„ Great Britain ...	12,000	3,000	— 9,000
„ Other countries ...	136,000*	23,000	— 113,000
Total ...	163,000	54,000	— 109,000
* Holland, 120,000 lire.			
Electric transformers.—			
From Austria	640,000	979,000	+ 339,000
„ France	30,000	20,000	— 10,000
„ Germany	2,586,000	2,302,000	— 284,000
„ Great Britain ...	12,000	27,000	+ 15,000
„ Switzerland ...	827,000	382,000	— 445,000
„ United States ...	—	13,000	+ 13,000
„ Other countries ...	16,000	3,000	— 13,000
Total ...	4,111,000	3,726,000	— 385,000
Parts of dynamo-electric machines and of transformers.—			
From France	78,000	118,000	+ 40,000
„ Germany	632,000	1,127,000	+ 495,000
„ Great Britain ...	60,000	64,000	+ 4,000
„ United States ...	122,000	100,000	— 22,000
„ Other countries ...	161,000	236,000	+ 75,000
Total ...	1,053,000	1,645,000	+ 592,000
Electrical apparatus.—			
From Germany	2,563,000	3,203,000	+ 640,000
„ Great Britain ...	138,000	344,000	+ 206,000
„ Switzerland ...	213,000	193,000	— 20,000
„ United States ...	362,000	235,000	— 127,000
„ Other countries ...	309,000	491,000	+ 182,000
Total ...	3,585,000	4,466,000	+ 881,000
Arc lamps.—			
From Germany	400,000	437,000	+ 37,000
„ Great Britain ...	—	1,000	+ 1,000
„ United States ...	11,000	3,000	— 8,000
„ Other countries ...	34,000	38,000	+ 4,000
Total ...	445,000	479,000	+ 34,000
Electric lamps, incandescent.—			
From Austria	615,000	831,000	+ 216,000
„ France	201,000	215,000	+ 14,000
„ Germany	1,938,000	2,222,000	+ 284,000
„ Great Britain ...	7,000	12,000	+ 5,000
„ Switzerland ...	108,000	159,000	+ 51,000
„ Other countries ...	208,000	384,000	+ 176,000
Total ...	3,077,000	3,823,000	+ 746,000
Carbons of all kinds for electro-technical purposes.—			
From Austria	321,000	212,000	— 109,000
„ Germany	590,000	467,000	— 123,000
„ Switzerland ...	27,000	4,000	— 23,000
„ Other countries ...	10,000	84,000	+ 74,000
Total ...	948,000	767,000	— 181,000

N.B.—25 lire = £1.

REVIEWS.

Essentials of Electricity. By W. H. Timbie. 1913. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

The author was formerly instructor in industrial electricity at the Pratt Institute, and the present volume is developed from notes used in short courses of trade lectures delivered to wiremen and others. Only D.C. problems and apparatus are described, and the work is confined to the statement and explanation of facts and laws and their applications. Practical operations constituting the craftmanship of electrical trades are left alone; the volume may be considered a text-book of theory as required by practical electricians.

In Chapter I, the distinction between pressure and current is explained very well by aid of water analogies; the peculiar difficulty experienced by many students in appreciating this distinction is not always allowed for by writers of elementary text-books. Many of the author's analogies are not beyond criticism, but they certainly possess the merit of clearing difficulties by affording a concrete (if not a scientifically accurate) conception of the quantities involved. The illustrations throughout the book are appropriate and clear, and valuable features are the numerous examples and problems in the text, and the concise summaries appended to each chapter. Bearing in mind the limited leisure of the class of men catered for, it is questionable whether it would not have been wise to omit some of the problems. A considerable number of the latter in each group involve exactly similar calculations; if all were worked through, there would be no objection to this redundancy, but there is considerable risk in leaving a selection to the student. It would be a good idea in later editions to italicise or otherwise identify those problems which should be worked at any cost. The omission of answers from the problems is unfortunate; their inclusion could do no harm to conscientious students, and they would form a valuable "control" for workers using the volume (as it is intended to be used), for reference purposes "on the job."

Ohm's Law and its application to simple and compound series and parallel circuits are explained with the same detail and clearness as characterise the opening chapter, and the reader who has read the volume carefully should find it easy to refer, at any time, to the exact section required. In the summary table dealing with parallel combinations, a man in a hurry will probably be annoyed to read that the "resistance of a parallel combination . . . . can be found by Ohm's Law plus a little common sense." A more satisfactory method is given in the text, but such witticisms should be kept out of reference summaries.

Electric power is dealt with in Chapter IV (American coinage being used in cost problems), and wire, wiring and distribution calculations are treated in Chapter V; American wire gauge numbers are used throughout. The principle of action of generators and motors is discussed in the next chapter, and from here onwards such differences as exist between American and English constructional practice in electrical apparatus somewhat detract from the value of the book in this country. "The north pole of any magnet is the place where the magnetic lines come out" is a very fair example of the author's peremptory, unqualified mode of expression—perhaps it is justifiable in such a work as this. Chapter VI also deals with wiring of motor starters, but the method of designing their resistance "steps" is not explained.

Chapter VII deals with the localisation and correction of generator and motor "troubles" in a manner convenient for reference. In Chapter VIII, dealing with primary batteries, it is tacitly assumed that wet or dry Leclanché cells are used and most of the space available is devoted to battery calculations; the "essentials" of electroplating, electrolytic corrosion and secondary cells are dealt with in the same chapter. Under "Wiring Diagrams" are illustrated and described various types of electric bells, buzzers and annunciators; fire and burglar alarms; gas lighters; engine ignition circuits; the telegraph and telephone; railway block signals and electric track switches; special lighting circuits; sign flashers and watt-hour meters. As this section occupies only 33 pages, there is little room for detailed treatment; more space might well have been allocated to telephones and electricity meters and other measuring instruments. The "carriage call" board shown on p. 256 appears to use an unnecessary number of lamps, yet figures "2" and "5" cannot be signalled. Electric heaters and cookers surely deserve some mention in such a work as this.

The book has a useful index and is well produced, but its price is rather high. Alternating-current supply is now so largely used in motor and other circuits that the restriction of the present volume to D.C. facts and laws is likely to limit its sale considerably.

Physikalische Grundlagen der Elektrotechnik. By Dr. F. F. Martens. (Vol. XLVI of "Die Wissenschaft.") Brunswick: Fried. Vieweg & Sohn. Price 7 M. 20 pf.

The book, of which this volume forms the first part, is intended to provide a general insight into the exact principles underlying electrical effects.

It is not an elementary treatise, for a general knowledge of electrical usage is assumed throughout; nor, on the other hand, does it rank with the more advanced text-books on the subject, for it is largely concerned with elementary theory, treated non-mathematically. The writer, however, has a clear style, and treats his subject in a fresh and interesting manner, so that the book will form a welcome and valuable help to the reader of the average elementary text-book in elucidating numerous difficulties which are too often left obscure in such books.

Part II, which is to appear shortly, will deal with the application of the principles here laid down to the construction of electrical apparatus and machinery.

The scope of Part I can be best understood from the chapter headings, which are as follows:—Chapter 1, Permanent Magnets and Their Fields; Chapter 2, The Magnetic Field Linked with a Current; Chapter 3, The Behaviour of Iron and Steel in Magnetic Fields; Chapter 4, Resistance, Voltage and Current; Chapter 5, The Heating Effects of a Current; Chapter 6, Electrostatic Effects; Chapter 7, Effects of Changing Magnetic Fields; Chapter 8, Electrolytic Conduction; Chapter 9, Electrical Effects Produced at the Contact Surfaces of Dissimilar Substances; and Chapter 10, The Various Systems of Units and Their Relations to One Another.

The book is well and fully illustrated.

The Design of Alternating-Current Machinery. By J. R. Barr and R. D. Archibald. London: Whittaker and Co. Price 12s. 6d. net.

This book is intended to be a companion volume to the book on direct-current electrical engineering written by one of the authors (since deceased).

The work opens with a discussion of complex wave forms and harmonic analysis. A useful *résumé* of the methods developed by Profs. Perry and Silvanus Thompson for analysing periodic functions is given. Some numerical illustrations are added, which tend to give beginners a much clearer idea of this somewhat difficult subject than a lengthy mathematical treatment of Fourier series. We are glad to see that the existence of higher harmonics as a possible disturbing factor when the frequency of the harmonics is close to the resonance frequency of the circuit is pointed out in this introductory chapter.

Insulation—really the most important problem in electrical engineering—is treated on modern lines in Chapter II. The essential difference between insulation resistance and dielectric strength is rightly insisted upon, together with the fact that the dielectric strength of an insulator depends chiefly upon its molecular structure. The effect of specific inductive capacity is illustrated by Fessenden's classical experiment. A good description of the apparatus for testing dielectrics is given, in addition to the various factors affecting the experimental results, such as temperature, time, &c. The application of these results to the design of machine insulation is explained by means of curves and tables.

The fundamental principles of transformers, together with descriptions of the leading types, are given in the succeeding chapter, the treatment being quite on ordinary lines.

Chapter IV is devoted to the losses, heating and efficiency of transfo mers, together with the standard methods of tes ing transformers. The various points are discussed in a clear manner, and there is a gratifying absence of purely empirical data, where these can be replaced by reasoned principles. A good feature is that the methods of testing are illustrated by figures from actual trials. The limitations of auto-transformers are briefly pointed out.

The design of transformers is dealt with in Chapter V by the mathematical method due to Messrs. Pohl and Bohle. This method is fully described, together with the proofs of the various theorems involved, and the designs of several transformers by well-known firms are worked through.

General considerations concerning alternators—including mechanical construction and the various types of windings—are described in Chapter VI. Mechanical construction is treated in an almost entirely descriptive manner, practically no attention being given to calculations concerning the strength of the various parts. Coloured diagrams are used for illustrating winding schemes, these adding greatly to the clearness of the letterpress.

The theoretical considerations concerning alternators, such as the E.M.F. equation, harmonics due to teeth, magnetic calculations, armature reaction, synchronous impedance, &c., are put forward in Chapters VIII and IX. The treatment is decidedly thorough, being largely based on the methods of the late Prof. Arnold, as given in his book "Die Wechselstromtechnik." A student, after working through these chapters, should face examination papers dealing with alternators with a comparatively light heart. We should have liked to see some examples appended, culled from examination papers if necessary, since these supply an effective test as to whether a student has really obtained an accurate knowledge, and, after all—quite apart from examinations—to be worth anything at all, knowledge must be thorough and accurate.

The various losses occurring in, and the efficiency and heating of, alternators are next examined. The treatment is quite modern; for example, the method due to Potier and Rüdenberg for approximately calculating the eddy-current loss in solid pole shoes is given. The standard methods of testing alternators are also briefly described.

Chapter IX deals with the vitally important subjects of parallel running, forced and free oscillations, &c., the methods used being very similar to those put forward by Dr. Rosenberg in his Institution paper several years ago. The chapter would have been improved had some numerical illustrations of the somewhat complex formulæ been given.

The actual design of alternators is next dealt with. The treatment follows what are now standard lines, and the several necessary constants are well on the safe side. The designs of a number of existing machines are worked through as examples of the method.

The concluding section of the book deals with rotary converters, Chapter XIII discussing transformation ratios, armature reaction and windings, with the aid of coloured diagrams.

Chapter XIV discusses voltage regulation, heating and efficiency, while the final chapter deals with the actual design of rotaries, the methods again being largely those due to Prof. Arnold.

Induction motors are not treated, the authors probably thinking that the book would be too bulky if these were dealt with in a sufficiently comprehensive manner.

Sixteen plates are inserted at the end of the book illustrating transformers, alternators and rotaries by various makers. A good index is appended.

The reviewer's general impression is that the book is remarkably cheap at the price asked, being in this respect an effective contrast with some recent American publications, and he is of the opinion that it will be largely used in technical schools and colleges.—H. G. S.

Radioactive Substances and their Radiations. By E. Rutherford, Professor of Physics, University of Manchester. 1913. Cambridge: University Press. Price 15s. net.

In 1904, Prof. Rutherford published a collected account of radioactive phenomena, entitled "Radioactivity." This was followed a year later by a revised and enlarged edition. During the years that have since elapsed, there has been an immense store added to our knowledge of the subject, and the present volume gives a concise and collected account of all the phenomena in connection with radioactive substances known to-day.

The distinguished author signalises, in the preface, some of the main directions of advance since the publication of his second edition of "Radioactivity." Mainly, this advance has consisted in a great increase in the amount and accuracy of our knowledge of the radiations from active substances, the nature of their absorption by matter, and of their connection with the transformations. The discovery of methods of counting single α particles has proved of great service in obtaining accurate data for the calculation of a number of important radioactive quantities and atomic magnitudes. The discovery of the recoil of radioactive atoms resulting from the expulsion of α particles has been very valuable as a means of separation of radioactive substances, and has also added another very interesting type of corpuscular radiation for study. Our knowledge of the series of transformations in active substances has been much extended. In 1905, 20 of these were known; the number is now 32, and there is some evidence that a few still remain undetected.

In one respect, however, there has been very little change. The transformation theory, advanced in explanation of radioactive phenomona, has undergone no essential modification in the interval. It has stood the test of time and is the only theory which gives a reasonable explanation for the facts. It will be remembered that the hypothesis was first advanced in 1903, by Rutherford and Soddy, that the atoms of radioactive elements are suffering spontaneous disintegration and that radiations accompany their break-up.

One of the most important chapters in the book is that on ionisation of gases by radiation. In this an account is given of the condensation experiments for the verification in a direct way of the theory that the conductivity produced in gases by the various types of radiation is due to the production of charged ions throughout the volume of the gas. Methods of measurement are stated very fully. Among others, the tilted electroscope, the string electrometer, and the quartz Piezo-electrique are described. A first-rate account is given of the methods in use for counting the alpha particles, including C. T. R. Wilson's photographic device.

The chapter on the γ ray is very full, and there is a long discussion as to the nature and meaning of these rays. The author is of the opinion that they are of the type of penetrating X-rays. The chapter on the Theory of Successive Transformations gives a good deal of the mathematics of this important subject.

There are three short appendixes. In the first an account is given of the methods of measurement of quantities of radium; in the second there is a brief statement of the remarkable method devised by C. T. R. Wilson for rendering visible the trails of single α and β particles.

Throughout the volume references to original work are consistently stated.

THE ELECTRIC VEHICLE.

Its Limitations and Selling Points for the English Market.

By J. W. BEAUCHAMP.

Within the present year attention has again been directed to the self-contained electric vehicle. The use of stored electricity as a means of propulsion for road vehicles is one of its very earliest applications, and possibly in no other direction had the efforts of electrical engineers met until recently with such disappointing results. The solution of the problem, simple in every respect excepting that of carrying the supply of electrical energy, has received a fresh impetus from the work of Edison, whose storage battery, although representing electrically only a modest advance upon the performance of the lead cell, has been so perfected in detail and construction that it offers to the engineering world a practical means of carrying and retaining electricity apart from its source of production, a facility which will appeal to workers in many fields of science and engineering.

Although the storage battery is used to a considerable extent in connection with public electricity supply, there is so far but little information available with regard to the effect on the supply business which might result if large numbers of batteries were in the possession of private individuals, and such information as is to hand is mostly derived from American practice and through sources which are interested in the exploitation of the electric vehicle.

The ordinary consumer of electric power is stationary with regard to the local supply undertaking, drawing his energy from a point on the mains system convenient to himself and at times of the day which suit the needs of his business; but the possessor of electric vehicles is a mobile consumer of energy, able within limits to draw his supply from points convenient to the supplier, and even to desert him in favour of another within reasonable distance. His convenience may, in many cases, be met by taking charging supplies during those hours when his vehicles are not needed, that is to say, in most cases at the time when the demand upon the supplier is not heavy.

These features of the business in view give the consumer a certain independence of the supplier, and although at the same time they put the latter in a good position for dealing with such requirements, they demand some forethought and attention if the fullest advantage is to be obtained.

It may be of interest to examine the position of the vehicle business to-day and consider the information available from the point of view of the British supply engineer who is seeking further activities for his plant.

The number of electric vehicles in use in this country to-day is not large, but it is by no means so insignificant as is generally supposed. Cabs are in daily use in London, whilst it is stated that a considerable fleet of electric taxis is now being prepared. The silent and rapid electric ambulance is an all too familiar sight in the City and the Dock area of East London. Several of the large West End stores, after trial of the Edison vans, have now ordered considerable numbers, and at least one Continental firm is having success amongst tradesmen with a light cart driven by lead batteries, and a particularly ingenious arrangement of the driving motor on the front axle.

On the Continent the lead battery appears to have made quite a permanent position for itself in connection with a certain class of road transit. Complete fire brigade equipments, tower wagons and light postal vans are used in considerable numbers, whilst one company has produced and sold large numbers of powerful tractors for municipal service. These machines are arranged for the ready attachment of dust vans, slop tanks, street sweepers, and watering carts, or may be used for carting material or for any service where heavy loads are to be transported at slow speeds.

In the States it would appear that light cars of the run-about class have been successful, whilst vans for heavy work, dock traffic and general store deliveries have become very numerous, the total number in use being stated at about 40,000.

Selling Electrics.—In undertaking publicity work with the object of encouraging the use of the electric vehicle and obtaining the business of battery charging, very careful attention must be given to the commercial aspect of the proposition from the user's standpoint under British conditions. A false move in this direction may do much harm, and where the work is put into the hands of a general light and power selling staff, precise limits and instructions should be given and adhered to, and embellishment of facts discouraged. Attention must be concentrated on the class of business which a study of the electric vehicle problem shows to be possible with gain to the user.

In comparison with horse and other methods of mechanical transport, the first cost of the electric is high, but its running cost is low. Therefore, commercial success depends upon obtaining the utmost possible ton-mileage out of the new vehicle. In many cases one of the advantages which it offers to the user is the incentive to overhaul his organisation and system of goods delivery, a selling point which must not be lost sight of.

In certain businesses cartage work consists principally of carrying heavy loads for considerable distances with few stops, as in delivering furniture, pianos, &c. In such cases it is possible to obtain a big day mileage.

In a large business by careful arrangement a van may be worked with two shifts of men, so avoiding to a great extent the cost of keeping it standing whilst the men attached to it take meals.

In other classes of work the opposite conditions obtain. Vans are used to deliver small weights at frequent intervals, covering but a short distance with many halts, as in the business of retailing bread, milk, and other food stuffs.

At present many large undertakings have a system of "distributor" carts going from house to house, and replenished at intervals by "feeder" carts from head-quarters. In such a case the use of an electric for the distributing duty might be more expensive than the present system, but employed to feed a number of horse carts it might achieve great economies.

Speaking generally, attention should at first be concentrated on business which calls for the transport of heavy loads at moderate speeds.

For City work the moderate speed of the electric van, coupled with its rapid acceleration and ease of control, is a positive advantage over the higher speed of petrol and steam vehicles, which are only able to maintain a fair average rate in dense traffic by a succession of stops and spurts, destructive alike to the machine and the road. In putting forward the commercial electric van proposition it is necessary to present clearly the salient advantages of this method of road transport, some of the principal of which are enumerated below. Others will be met with from time to time in the course of business and should be carefully recorded.

1. Extreme simplicity and reliability of the motor and controlling apparatus in which there are no reciprocating parts and no mechanical gearing for regulating speeds or reversing.

The electric motor has already replaced to a very considerable extent the use of various kinds of engines for driving machinery in factories; this is largely due to the simplicity of the rotary machine as compared with any reciprocating apparatus in which wear and tear, consumption of lubricants, and risk of breakdown are immensely greater.

All these merits of the tried and tested electric motor are now available for mechanical road transport and they show up most advantageously in comparison with steam and petrol engines, which suffer far more when used for driving vehicles than when stationary, owing to the roughness of roads and vibration.

2. The control of an electric vehicle is of the simplest description, and is furnished by one lever or pedal combined with a steering wheel.

It is unnecessary to dismount in order to perform risky gymnastic feats with the starting handle, as in the majority of petrol cars.

Speed variation and reversal are obtained without clutches or gearing.

Starting and stopping and speed change are smooth and silent.

There is no emission of smoke, cinders or odour, and no back firing or adjustment of fuel or air supply.

Driving becomes merely a matter of steering, and any person can operate an electric vehicle after a simple demonstration.

The efficiency and welfare of the machine are practically independent of the skill and knowledge of the driver.

The driver of an electric business cart is able to keep himself sufficiently clean to handle goods and book private house orders.

3. Speed.—The speed of the electric vehicle is limited by its design, and it becomes impossible to exceed a certain predetermined rate even when the van is unloaded, so removing the drawback peculiar to most mechanically-driven vehicles that they may be raced under certain conditions. Records have proved that increase in the speed of a mechanical vehicle beyond its proper limit causes the cost of operating and maintenance to rise out of all proportion to the extra duty obtained. This is particularly the case when the vehicles are lightly loaded, and one of the chief points in favour of the electric van is that it cannot be raced when empty, a proceeding which is most destructive to the ordinary steam and petrol van.

4. Absence of the use of inflammable spirit.

The vehicles are driven and lighted by electricity.

The cost and risk of handling and storing petrol or other fuels and making acetylene are entirely eliminated, and the expense of insurance is reduced.

5. Great reduction in fire risk when on the road and when in garage.

6. The vehicles do not drop liquids on the road. Owing to the simplicity of the moving parts, lubricating is reduced to a minimum, and the oil and grease nuisance, characteristic of most mechanical transport methods, is absent. The waste of petrol and oils has an injurious effect upon the roads, and gives rise to danger of explosion in drains and sewers, whilst extra cost for cleaning is involved and damage done to the rubber of tires, insulated wires, and other parts of the vehicles.

7. Silence in operation is the most striking feature of the electric vehicle, owing to the simple turning movement and the absence of all reciprocating parts, explosions, and changing of mechanical gears. These vehicles, whether in the form of pleasure cars or heavy vans, are absolutely silent, an advantage for which perhaps few are prepared to pay, but one which in the aggregate appeals to everyone very much.

A preponderance of the electric-driven vehicle on our City roads would effect a great reduction in the nerve destroying clatter, which is a feature of them to-day.

A certain type of light electric car has already been put into use for the delivery of milk in residential districts in the early morning. Its silence in operation is one of its chief recommendations, contrasting in a striking manner with the clatter and jingle which are associated with morning deliveries by the horse-drawn cart.

The electric car can be turned in an extremely small radius, in some cases, little greater than its own length ; a feature which gives it an advantage in manipulating heavy loads in railway yards, markets, and other congested areas.

8. Guarantees can be obtained from most battery makers. The Edison Storage Battery Co. offer the following terms :—

"Any defect in workmanship or material will be corrected free of charge if notice be given within one year of delivery.

"If, during six years (or four for traction service) from date of delivery, any cells are found to be incapable of developing full-rated capacity, under normal conditions, we will, at our discretion, either replace them with other cells of full-rated capacity, or repair such cells to restore their full-rated capacity, free of charge, f.o.b. our works, provided that all said cells are installed in a manner approved by us, and that all said cells are cared for and operated in accordance with our standard printed instructions."

Most of the leading makers of lead cells for traction service are also prepared to quote inclusive terms for maintenance based on mileage.

9. Increased useful life of tires. Owing to the simple rotary motion of the electric motor, and the total absence of pounding on the tires, and less slip at starting, it is found in practice that the life of the tires is considerably greater on an electric vehicle than in the case of petrol or steam.

10. The cost of electrical energy at current rates for running these cars and vans varies from one-third to one-half of the cost of the petrol required for motor vehicles of the same carrying capacity.

The cost of coal and petrol has risen rapidly within recent years. In the latter case the price appears to be subject to variations out of all proportion to its cost of production, whereas the cost of electrical energy, although to some extent dependent upon the cost of fuel, shows a steady tendency to fall owing to the rapidly increasing demand which enables suppliers to employ larger and relatively less expensive and more efficient machinery for its production.

11.—The operation of the van is independent of weather and climate, whilst its extremely powerful starting effort makes it most useful in temporary road difficulties, such as soft ground, snow, &c.

The electric wagon can be garaged where horses would not be permitted for sanitary reasons, or on account of the noise which is associated with stables.

12. Speed.—In putting forward the claims of the electric pleasure car, the seller is often met with the objection that its maximum economical speed is inferior to that of the petrol car.

This, at the present time, is true, but it is not so serious an objection as is generally imagined.

In the case of heavy street traffic, owing to certain features of the electric car, its average speed through the working day more nearly approaches its maximum than is the case with the petrol machine.

Moreover, in practice a powerful touring car can seldom be used at its top speed for sufficient length of time to constitute any real advantage to the owner. Powerful cars are rather expensive toys, from which occasionally the owner is able to obtain the luxury of excessive speed for a short time.

In putting forward the small "electric" for business and city work, one of its most promising fields, it is desirable to point out that at the present time owners of large petrol cars use them to a considerable extent for short runs in connection with their business. This is most uneconomical, the petrol consumption, wear and tear of machine and tires being out of all proportion to the benefit gained on these short runs, whilst the massive car helps to add unnecessarily to the congestion of the thoroughfares.

In many cases a business man would find it an economical proposition to reserve his petrol car for distance and pleasure work, and maintain, at the same time, a small and convenient electric "Runabout" for business purposes and evening work in the city.

The spectacle of one man driving himself about the narrow streets of our business districts in a car capable of carrying five or six people along the road at 40 miles an hour, is not infrequently seen, and certainly does more to add to the cost of motoring than the owner generally imagines.

THE USE OF IRON IN ELECTRICAL MEASURING INSTRUMENTS.*

In a paper recently read by Herr Dolbrowsky before the Elektrotechnischer Verein, he discusses the present state of commercial electrical measuring instrument construction, and points out that, considered as engineering structures, a great deal of improvement is still desirable. The demand for increased accuracy has led to the introduction of much delicate work, and, in the writer's opinion, to the sacrifice of reliability and stability. He suggests that this particular branch of electrical engineering has not yet emancipated itself from certain academic rules and ideas, and that future improvements are to be expected by a closer application of the sound engineering methods which have proved so successful in dynamo designing.

One of the established principles, for instance, in the design of the dynamometer type of instrument, consisting of a fixed coil and a moving coil, has been that the presence of iron must be avoided at all costs if accuracy is to be retained. This type of instrument is especially important in connection with alternating currents for which wattmeters are so essential, especially such as can be accurately calibrated by direct-current methods. As hitherto usually made, without iron, these instruments, although often highly accurate when judiciously used, are liable to considerable errors due to outside magnetic fields, and due to deformations which can be easily set up, if they are roughly handled, owing to the necessary absence of solid metallic supports for the coils. Good modern wattmeters of this type seldom have moving systems weighing less than 4 grammes, whilst the maximum deflection torque is only about 4 cm.-gramme. This small torque involves the use of very delicate jewelled bearings, and makes the whole construction very far from robust.

The introduction of iron into the stationary part of such an instrument, offers the double advantage of increased torque and freedom from outside field effects, but the production at the same time of serious hysteresis and phase errors has been feared, and has prevented its general use.

Herr Dobrowolsky and the Allgemeine Elektrizitäts Gesellschaft have, however, recently succeeded in bringing out a line of dynamometer wattmeters provided with ample iron magnetic circuits, and yet showing a high degree of accuracy. These are known as "Ferro-dynamic" instruments. The arrangement adopted is shown in fig. 1 diagrammatically. Many previous more or less successful attempts to produce instruments of this type have been made, *e.g.*, by Benischke, Lotz, Sumpner, Drysdale, and others, and the chief advance claimed for the new instruments is simply a careful selection of the dimensions so as to enable the advantages due to the high

* *E.T.Z.* Dr. M. Dolivo-Dobrowolsky.

permeability of the iron to be obtained without the inaccuracy du to its remanence and hysteresis becoming too great. When a closed iron circuit has been magnetised and the excitation is removed, a certain amount of residual magnetism always remains, as shown by B, fig. 2. In order to remove this, a certain negative "coercive force" c has to be applied. This coercive force may be looked upon as overcoming a certain number of ampere-turns which have become inherent to the iron through its magnetisation, and which tend to maintain the residual flux B. The fact that these inherent ampere-turns are not actually quite constant may be neglected in this connection. If now an air-gap is introduced into the iron circuit and the magnetic cycle is carried out once more between the same limits, the loop will have the long narrow form shown to the right, with an amount of residual magnetism which is far smaller than before. This arises from the fact that whilst the number of inherent ampere-turns are practically unchanged, they now have to

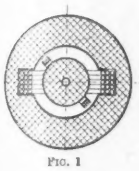


Fig. 1

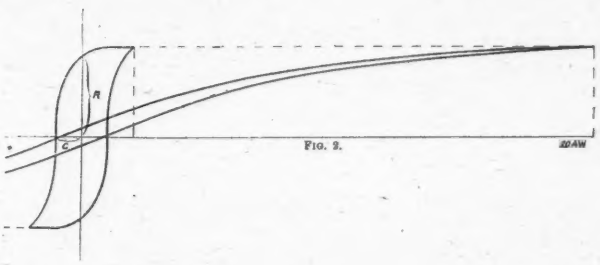


Fig. 2.

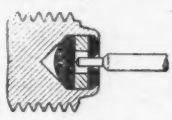


Fig. 3

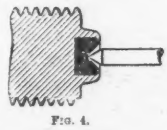


Fig. 4.

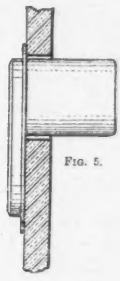


Fig. 5.

overcome the high magnetic resistance of the air-gap as well as that of the iron path. Suppose the length of iron path is 10 cm., and the flux density is 5,000 lines per sq. cm. requiring about 2 ampere-turns per cm., so that the total ampere-turns to be applied without any air-gap = 2 × 10 = 20. The coercive force will then have some value less than 20 ampere-turns. Suppose now an air-gap is introduced requiring the application of a total of 200 ampere-turns in order to produce the density of

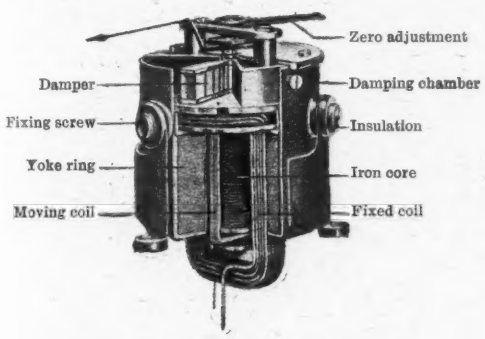


Fig. 6.

5,000, *i.e.*, the total magnetic resistance is made 10 times as great. The intrinsic ampere-turns (or the coercive force) will still be as before—something under 20, and the residual magnetism will, therefore, be reduced to one-tenth of its original value. With greater air-gap the residual magnetism can be still further reduced. This leads to the following general rule:—"The residual magnetism, stated as a percentage of the total magnetism, cannot exceed the

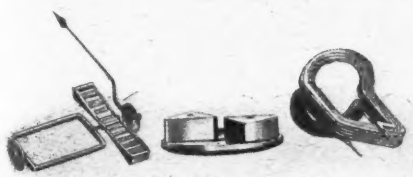


Fig. 8.

percentage which the ampere-turns for the iron path are of the total ampere-turns for iron and air." In order, therefore, to reduce the residual magnetic effect to less than 1 per cent., it is only necessary to arrange for the iron paths to absorb only 1 per cent. of the total applied ampere-turns.

In the A.E.G. ferro-dynamic instruments, for instance, good (alloyed) iron stampings are used, shaped as in fig. 1, so as to give a very short iron path, and with an air-gap of 5 mm. at each side, and it is found that of the total of about 200 ampere-turns applied the iron path only absorbs about 1 ampere-turn. The residual magnetism must, therefore by the rule, be reduced to less than ½ per cent., and experiment fully confirms this. The whole weight of iron is something like 300 grammes, and yet the per cent. remanence is no more than is often met with in modern moving soft-iron instruments, in which the whole iron present only weighs perhaps 1 gramme. It cannot, therefore, be said that much iron necessarily means much residual magnetism.

In order to avoid a hysteresis error also, suitable dimensioning is all that is necessary. The effect of hysteresis loss in the iron is to introduce a small phase difference between the current in the magnetising coil and the flux produced by it. The amount of this error depends on the ratio of the hysteresis watts to the whole volt-amperes taken by the coil, and can be made negligible by keeping this ratio small. In fact, the same requirement as for the reduction of the remanence error will remove the hysteresis error, for it has been shown that remanence becomes negligible if the ratio of the ampere-turns used in the iron to the whole ampere-turns of the coil is kept low and the hysteresis error is avoided if the ratio of the watts in the iron is small compared with the total volt-amperes of the coil. Both these results are attained by keeping the length of iron path in the direction of the flux as short as possible, and using a comparatively large air-gap. The total ampere-turns used should not be made too great as that involves much space for the coil, and consequently a long iron path. On the other hand, the ampere-turns must not be too small, as that means a reduced air-gap and reduced volt-amperes. By bearing these points in mind it has been found possible to reduce the phase error to a negligible value. For instance, in one of these ferro-dynamic watt-meters when the current coils and volt coils are supplied from separate sources with exactly 90° phase difference between them, the deflection (which should be zero if no phase error exists in the meter) was found to amount to only ·3 per cent. of the full scale deflection. This extremely small error under such conditions (practically measuring power with a power factor of 0) proves that the meters are amply correct for practical purposes without the use of any kind

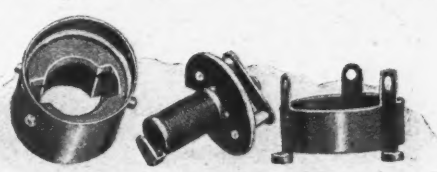


Fig. 7.

of compensation, though, if desired, it is quite possible to remove even this very small error by inserting a small inductance in series with the volt coil or otherwise. The following additional data for such a wattmeter are given:—

Total weight of moving system, including spiral springs, air damper, &c., 4 gr.

Maximum deflecting torque (about double the usual figure), ·8 cm. gr.

Ratio torque/weight = ·8/4 = ·2.

Watts lost in the current coil, 2·4.

Watts lost in the voltage coil alone, ·015.

Current in the voltage coil at 100 volts, ·04 ampere.

Coefficient of self-induction of the voltage coil alone, ·007 henry.

Ratio of non-inductive manganin resistance to the copper resistance of the volt coil for 100 volts, 75.

Ditto, for 200 volts, 150.

These figures show that the instruments are well up to the mark of good modern switchboard wattmeters, but have about double the usual deflecting torque.

This alone brings decided advantages with it, such as the use of solid collar bearings, as in fig. 3, in place of the usual delicate jewelled bearing of fig. 4.

Further, the use of the iron renders the new meter extraordinarily free from outside field effects. The whole construction is very compact and enables a flat instrument, as shown in fig. 5, to be obtained for switchboard work with only a comparatively narrow tube containing the mechanism passing through the face of the board.

Further details of the instrument are shown in figs. 6, 7 and 8. The ferro-dynamic instruments are suitable for D.C. as well as A.C., and can be accurately calibrated with D.C.

The principle lends itself specially well to the production of registering wattmeters, for which large deflecting torques are required. Without taking excessive currents, such torques as 30 cm. grammes can be obtained, the volt coil only taking about ·1 ampere, and the phase error not exceeding ½ per cent.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

BRAZIL.—The Government have decided to levy a surtax of 2 per cent. *ad valorem* on all goods imported through the Customs House of Aracaju, in the State of Sergpe, the proceeds of the tax to be used for port works.

H.M. Consul-General at Rio de Janeiro has forwarded to the Board of Trade certain important information as to the charges for warehousing goods in Brazil. It appears that the charges for goods stored in "internal" warehouses are now levied on a uniform basis at all Brazilian ports as follows:—

Up to 30 days	1 per cent. per month.
Up to 60 days	1½ per cent. per month for the whole period.
Up to 90 days	2 per cent. per month for the whole period.
For periods exceeding 90 days ...	3 per cent. per month for the whole period.

The charges do not begin to accrue until the completion of the discharge of each separate consignment into the warehouse. Fractions of a month are counted as a whole month. The percentage rates are calculated on the official valuations of the goods according to the Brazilian Customs Tariff. Thus, for example, in the case of goods on which the rate of Customs duty is 1,200 reis per kilog., representing an *ad valorem* rate (*razao*) of 50 per cent. The official valuation would therefore be 2,400 reis per kilog., and it is on this valuation that the percentage warehousing charges are calculated. It will be seen, therefore, that heavy expenses may be incurred by leaving goods in warehouse for any lengthy period.

Certain classes of goods (as enumerated in Table H, appended to the "Consolidação das Leis das Alfandegas") may be *desapchado sobre agua, i.e.*, the goods can be cleared and duties paid before they are discharged from the steamer. The advantage of this is, that although such goods have to pass through the warehouses, they are exempt from warehousing charges if removed within three working days counting from the day of entry. If the goods are not removed within that period, they incur double the usual percentage charges. Goods not mentioned in Table H pay one month's warehousing charge, even if they only pass in transit through the warehouse.

CUBA.—The Cuban Government propose to create free ports at Santiago and Cienfuegos for the entry of goods, free of duty, which are intended to be re-imported either in the condition in which they were landed, or after having been re-packed or subjected to industrial processes.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,662. "Electric cables." F. J. BRISLEE, J. L. PACKER AND BRITISH INSULATED AND HELSBY CABLES, LTD. July 21st.

16,673. "Governors for variable-speed or reversible machines." L. CREPLET. (Convention date, July 23rd, 1912, Belgium). July 21st. (Complete.)

16,675. "Electric adaptor or connector." J. S. HOLMES. July 21st.

16,684. "Electric batteries and accumulators." F. SABLON. July 21st.

16,691. "Electric water gauges." J. RAJCZY. July 21st. (Complete.)

16,693. "Swivel lampholders." C. N. SOWDEN AND D. WOOD. July 21st. (Complete.)

16,694. "Swivel lampholders." C. N. SOWDEN and D. WOOD. July 21st. (Complete.)

16,696. "Telephone machine switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, Belgium.) July 21st.

16,705. "Trolley heads for overhead electric traction." E. H. UNDERWOOD. July 21st. (Complete.)

16,709. "Sockets for electric leads." A. G. BLOXAM. (R. Bosch, firm of, Germany.) (Addition to 6,551, 1913.) July 21st. (Complete.)

16,725. "Device for starting and stopping submarine syrens." SIGNAL G.m.b.H. (Convention date, July 29th, 1912, Germany.) July 21st. (Complete.)

16,742. "Pocket lamp with writing attachment." T. SENDLER, Jun. (Convention date, February 26th, 1913, Germany.) July 21st. (Complete.)

16,753. "Electric meters." H. ARON ELECTRICITATSZAHLERFABRIK G.m.b.H. (Convention date, March 10th, 1913, Germany.) July 21st. (Complete.)

16,754. "Controlling apparatus for electric circuits." A. REGAL. July 21st. (Complete.)

16,770. "Electric incandescent lamps." C. W. READ. July 22nd.

16,791. "Lamp hanger for high-tension series lighting." G. BARKER. (Thompson Electric Co., United States.) July 22nd. (Complete.)

16,792. "Apparatus for electrically operating planing-machines and the like reciprocating tools." LANCASHIRE DYNAMO MOTOR CO., LTD., A. P. WOOD and R. S. MCLEOD. July 22nd.

16,807. "Controlling gear for, or connected with, electrically-driven hydraulic pumps." J. A. TOWLER. July 22nd. (Complete.)

16,813. "Water-heater by means of electricity." J. A. B. SCHLEGEL and K. SPARR. July 22nd.

16,815. "Cash stamp parcel, or like tray, in combination with an illuminated sign for advertising purposes." R. A. PANTLIN. July 22nd.

16,820. "Electrical resistance devices suitable for use as heating elements and as rheostats." A. C. WHISH. July 22nd.

16,840. "Change-over switches." H. H. BERRY and W. J. MARKHAM. July 22nd.

16,841. "Combined electric switches and plugs." H. H. BERRY and W. J. MARKHAM. July 22nd.

16,853. "Stereoscopic X-ray systems." H. C. SNOOK and E. W. KELLY. (Convention date, August 15th, 1912, United States.) July 22nd. (Complete.)

16,859. "Telephone exchange systems." W. AITKEN. July 22nd.

16,885. "Electric switches." H. LUCAS and O. LUCAS. July 23rd.

16,890. "Interlocking-mechanism, such, for instance, as used in railway signalling." SIEMENS BROS. & Co., LTD., and W. E. SCOURFIELD. July 23rd. (Complete.)

16,917. "Method of and means for the production of electric current." W. DUBILIER. (Divided application on 14,015/12, June 15th.). July 23rd.

16,958. "Mica earth arresters for use in wireless telegraphy." L. C. WRIGHT. July 24th.

16,963. "Electrical apparatus for internal-combustion engines." W. A. TRIER. July 24th.

16,964. "Protective attachment for telephone mouth-pieces and ear-pieces." S. T. RICHARDSON. July 24th.

16,969. "Telegraphic receiving-apparatus adapted to actuate a perforator or analogous device." EASTERN TELEGRAPH CO., LTD., and J. S. JENKINS. July 24th.

16,975. "Electricity meters." J. F. WATTS. July 24th.

16,979. "Means for driving dynamos attached to vehicles." C. E. PEHRSSON. (Divided application on 18,482, 1912, August 12th.) July 24th. (Complete.)

16,985. "Electrode for uniformly heating interior cavities of a living body by diathermic treatment." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt. Ges., Germany.) July 24th. (Complete.)

16,998. "Electrical resonance operated apparatus." H. W. HANDCOCK, A. H. DYKES, and W. DUDDELL. (Addition to 1,395, 1913.) July 24th. (Complete.)

17,038. "Automatic switch means for telephone systems." K. E. ERICSSON and G. W. DAHLSTROM. (Convention date, July 26th, 1912, Sweden.) July 24th. (Complete.)

17,066. "Apparatus for automatically indicating and recording the combined efficiency of a steam motor and coupled electrical generator." R. S. KENNEY and F. GILMAN. July 25th.

17,086. "Apparatus for regulating the light-intensity of electric arc-lamps." SIEMENS-SCHUCKERTWERKE G.M.B.H. (Convention date, July 25th, 1912, Germany.) July 25th. (Complete.)

17,092. "Incandescence electric lamps." A. HOW. July 25th.

17,109. "Arrangements for automatically regulating the conditions of electric systems." H. LONGTON. July 25th.

17,112. "Temperature alarm." J. F. J. MALONE. July 25th. (Complete.)

17,124. "Arrangements for transmitting receiving signals." SIEMENS BROS. AND CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) July 25th. (Complete.)

17,125. "Devices for feeding the paper in recording apparatus." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) July 25th. Complete.)

17,126. "Measuring instruments for high-frequency currents." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) July 25th. (Complete.)

17,137. "Electric relay." SIEMENS & HALSKE AKT.-GES. (Divided Application on 3,432/13, February 10th. Convention date, February 12th, 1912, Germany.) July 25th. (Complete.)

17,141. "Aerial signalling appliance." R. B. BRADFORD. July 26th.

17,156. "Protective arrangements for alternating-current generators." A. M. TAYLOR. July 26th.

17,164. "Method of localising the radiant point of electromagnetic waves and apparatus therefor." R. WANIBUCHI. July 26th. (Complete.)

17,174. "Electrical fuses or cut-outs." C. W. COX. July 26th.

17,190. "Electric light fittings." C. J. LANE. July 26th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

METHOD OF AND APPARATUS FOR PRODUCING HIGH-TENSION OR HIGH-FREQUENCY ELECTRIC CURRENTS. W. Dubilier. 8,197. April 4th.

TELEPHONE RECEIVERS. A. Plecher. 13,167. June 4th.

MEANS FOR SIGNALLING AND CONTROLLING THE COURSE OF VESSELS SO AS TO ASSIST THE PRESENT RULES OF THE ROAD AT SEA AND PREVENT COLLISIONS AND STRANDING. D. J. Morgan. 13,463. June 8th.

IMITATION CANDLE LAMPS. C. Damey, C. M. Escare and P. F. Escare. 15,456. July 2nd.

ELECTRODES AND HOLDERS THEREFOR FOR ARC LAMPS. M. A. Herwig. 15,927. July 8th.

TELEPHONE MACHINE SWITCHING SYSTEM. Western Electric Co., Ltd. (Western Electric Co.) 15,952. July 8th.

ELECTRIC BATTERY LAMPS. H. Hunte. 16,126. July 10th.

THERMOSTATS FOR CONTROLLING ELECTRIC CIRCUITS. A. W. Prim and F. W. Roper. 16,817. July 12th. (Cognate application, 27,780, 1912).

ANODES FOR USE IN ELECTROLYTIC APPARATUS. G. P. M. Lee and W. A. Brame. 16,475. July 15th.

PROCESS FOR REPAIRING ELECTRIC INCANDESCENT LAMPS. E. Cervenka. 16,885. July 19th. (July 19th, 1911.)

ELECTRIC HEATERS. H. H. Grundy. 18,017. August 3rd.

VAPOUR ELECTRIC DEVICES. British Thomson-Houston Co., Ltd. (General Electric Co.) 18,372. August 9th.

ELECTRICAL APPARATUS FOR IGNITING GAS OR INFLAMMABLE VAPOUR. F. Nehmer. 18,799. August 16th.

METHOD AND APPARATUS FOR ELECTROLYTICALLY RECOVERING AND REFINING TIN. G. Michaud and E. Delasson. 20,557. September 9th.

CONTROLLERS FOR ELECTRIC MOTORS AND LIKE APPARATUS. G. Ellison and M. R. H. Mueller. 22,959. October 8th.

TELEPHONE INDICATING APPARATUS. M. S. Conner. 23,812. October 18th.

COLD ELECTROLYTIC PROCESS FOR THE RECOVERY OF TIN FROM WASTE TINNED METALS AND ALLOYS. A. L. C. Nodon. 24,203. October 23rd.

ARRANGEMENT OF THE EXCITING WINDINGS OF THE ROTATING FIELD SYSTEMS OF ELECTRIC MACHINES. F. Ljungstrom. 24,484. October 26th. (October 26th, 1911.)

BOX OR PACKING FOR ELECTRIC LIGHT BULBS AND THE LIKE. H. W. Burbery, E. N. Hillier and W. A. Thompson. 24,596. October 28th.

ELECTROLYTIC CELLS. E. A. Allen and H. I. Allen. 26,169. November 14th.

METHOD OF REDUCING THE LOSS OF ENERGY IN LINES FOR VARIABLE ELECTRIC CURRENTS. F. A. Becker. 27,585. November 29th. (Addition to No. 65 of 1911.)

ELECTRIC INCANDESCENT LAMPS FOR MOTOR VEHICLES. A. A. Godin. 29,149. December 18th.